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A REVISION OF THE GENUS SCIARA OF THE FAMILY MYCETOPHILIDÆ (Diptera)

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In working over the Cornell University collection of specimens of Sciara, family Mycetophilidæ, thirty-one new species collected in the United States were discovered. Consequently it was thought advisable to revise Dr. Johannsen's Sciara key, found in the Maine Agricultural Exp. Sta. Bull. No. 200, Part IV, pp. 117–123. The work was done under Dr. Johannsen's direction.

Dr. Johannsen, in his classification of the species of the genus Sciara, has divided them into two main groups, those whose wings have setose media and cubitus and those whose wings have no setæ on these veins. Other scientists, in their description of new species of Sciara, have frequently overlooked this important structural character. In an effort to call more particular attention to this feature and to avoid the possibility of neglecting it in the future descriptions, a new genus is proposed for those species having no setæ on the media and cubitus. Since the type species of the genus Sciara, *thomæ* L. (Syst. Nat. Ed. XII, II. 976.39 (Tipula) 1767), has subsequently been found to have setose media and cubitus, those species having this character are left in the genus Sciara.

About half of those species of the male sex under the new genus have a hypopygium with one or two clusters of setæ at the base on the median ventral line. No males of the genus Sciara as above restricted exhibit this character. Although this structure should not be overlooked in the description of a species, it would be inadvisable to make use of it as a generic character, since it cannot be designated in females.

The larvæ of all those species observed, under the genus Sciara as above restricted, *i. e.*, those species possessing setose media and cubitus, have the habit of migrating in a chain-like line. None of the observed larvæ of the *Neosciara* species exhibit this feature.

Neosciara new genus.

This genus includes species which would formerly have been placed under the genus Sciara, but which are now placed under the above genus because they lack setæ on the cubitus and media.

Face short; palpi 4-jointed, the first very short and not always differentiated from the second; antennæ 2 plus 14 jointed; 3 ocelli, the laterals remote from the eye margin. Thorax moderately arched. Legs slender, tarsal claws not toothed. Wings microscopically setulose, not hairy; cubitus and media with no setæ.

Type: *Sciara coprophila* Lintner.

TABLE OF NORTH AMERICAN SPECIES OF THE REVISED GENUS *Sciara* AND OF *Neosciara*.

a. Genus SCIARA. Costa, radius, media except sometimes the petiole and cubitus of the wings distinctly though sparsely setose.
  *b. Large southern species, 6 mm. or more in length; males undescribed. *cingulata* Rübsaamen
  bb. Medium or small species.
    c. R_1 ends noticeably proximad of the fork of M.
      *d. Petiole of cubitus one-eighth as long as the basal section of M. (Fig. 219); clasper (Fig. 100); N. Y. .... *vicina* Joh.
      dd. Petiole of cubitus scant half or more than half as long as the basal section of M.
        e. Clasper with at least one stout apical spine.
          f. Clasper with a single stout spine; costa produced two-thirds the distance from the tip of R_s to M_1 (Fig. 220); clasper (Fig. 101); Cal. .... *dives* Joh.
          ff. Clasper (Fig. 1) with several stout apical spines and one more prominent subapical spine; costa produced less than two-thirds the distance from the tip of R_s to M_1. (Fig. 32)....1. *forceps* n. sp.
        ee. Clasper with no *stout* apical spines.
          f. The perpendicular distance from the crest of the arc of M_1 to that of R_s greater than the perpendicular distance from the tip of R_s to M_1 (Fig. 33). Petiole of cubitus longer than the base of M. Clasper (Fig. 2) ....2. *multisetifera* n. sp.

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* This table is based largely on male characters, only a few well defined species represented by females alone are included; *cingulata* is placed under both genera since it is not certain whether the cubitus and media have setæ or not. By wing length is meant the distance from the humeral cross vein to the tip of the wing, measured parallel to the longitudinal axis.

The figures and descriptions of those species not designated as new may be found in the Maine Agr. Exp. Sta. Bull. 200, part IV.

All the types and some paratypes of the new species are to be found in the Cornell University collection.

ff. The perpendicular distance from the crest of the arc of M_1 to that of R_s less than the perpendicular distance from the tip of R_s to M_1.

g. Petiole of cubitus less than three-fourths the length of the base of media; costa produced at least two-thirds the distance between the tips of R_s and M_1 (Fig. 34). Clasper (Fig. 3), 3. *cylindrica* n. sp.

gg. Petiole of cubitus more than three-fourths the length of the base of media; costa not produced two-thirds the distance between the tips of R_s and M_1.

h. Wing wide at base, subcosta exceptionally long and almost reaching the costa, base of R_s evanescent; setæ or slender spines at tip of clasper larger than the setæ along the inner margin; tip of R_s ends proximad of tip of M_2 (Fig. 35). Clasper (Fig. 4). (See figures in this paper)......4. *congregata* Joh.

hh. Wing normal at base; subcosta normal; base of R_s distinct; setæ at apex of clasper not larger than those along its inner margin; tip of R_s ends slightly distad of tip of M_2 (Fig. 36). Clasper (Fig. 5)........................5. *psittacus* n. sp.

cc. R_1 ends about opposite or distad of the base of the fork of M; species 2.5 mm or more in length.

d. Petiole of cubitus over one-half as long as the basal section of M.

e. R_1 ends about opposite the forking of M. (Fig. 221).....*futilis* Joh.

ee. R_1 ends distad of the forking of M. (Fig. 266)..........*abdita* Joh.

dd. Petiole of cubitus less than one-fourth as long as the basal section of M.

e. Humeri, pleura in part and hypopygium (Fig. 103) more or less yellow; knob of halteres dark.............................*ochrolabis* Loew.

ee. Thorax and abdomen black.

f. Clasper with two distinct clusters of stout spines, one apical, the other subapical (Fig. 104).........................*sciophila* Loew.

ff. Clasper of different structure.

g. Halteres and coxæ yellow.

h. Clasper with a few, about 5 subequal stout spines along the inner margin (Fig. 139)..........................*habilis* Joh.

hh. Clasper (Fig. 6) with many, over 12 subequal, rather slender spines along the inner margin. Wing (Fig. 37), 6. *habilis* var.

gg. Knobs of halteres and coxæ fuscous. Wing (Fig. 38). Clasper (Fig. 7)...................................7. *globosa* n. sp.

Genus NEOSCIARA. Media and cubitus without setæ.

Large southern species, 6 mm. or more in length; males undescribed.

c. R_1 ends distad of the base of the fork of M; wings blackish (Fig. 218). *picea* Rübsaamen

*cc. R_1 ends about opposite the base of the fork of M....*cingulata* Rubsaamen

bb. Medium or small species.

c. R_1 ends distad, or opposite (not more than one-tenth of wing length proximad) of the base of the fork of M, and base of R_s at or proximad of a point midway between the humeral crossvein and the tip of R_1.

d. Thorax yellowish to rufous, coxæ and femora dull yellow.

e. Claspers large, triangular, no terminal stout spine. Petiole of cubitus less than one-half as long as the basal section of media (Fig. 111). *fulvicauda* Felt

ee. Clasper (Fig. 8) cylindrical, with one stout apical spine. Petiole of cubitus more than one-half as long as the basal section of media. Wing (Fig. 39)...................................8. *falcata* n. sp.

dd. Thorax dusky.

e. R_s ends proximad of the tip of M_2; halteres dark.

f. Clasper with 2 median lobes (Fig. 109); costa produced about one-half way from tip of R_s to M_1............*tridentata* Rubsaamen

ff. Clasper without median lobes; costa produced distinctly over half way from tip of R_s to M_1.

g. Clasper with 2 or 3 stout apical spines.

h. Hypopygium with 2 clusters of setæ, 1 on each side of the mid-ventral line, no long slender seta on the inner margin of the clasper (Fig. 9). Costa produced not over two-thirds the way from the tip of R_s to the tip of M_1 (Fig. 40)...9. *fochi* n. sp.

hh. Hypopygium with no cluster of setæ on each side of the mid-ventral line, at least one long slender seta on the inner margin of the clasper (Fig. 10). Costa produced over two-thirds the distance from the tip of R_s to the tip of M_1 (Fig. 41) ... 10. *joffrei* n. sp.

gg. Clasper with no stout apical spines................*munda* Joh.

ee. R_s ends opposite or distad of the tip of M_2.

f. R_1 ends distad of the forking of M; halteres dark.

g. Clasper with a mesal process. R_s ends noticeably distad of the tip of M_2.

h. Mesal process of claspers robust (Fig. 106 m); wing (Fig. 225), *dux* Joh.

hh. Mesal process of claspers slender (Fig. 107 m); wing (Fig. 226). *imitans* Joh.

gg. Clasper (Fig. 11) with no mesal process. R_s ends about opposite the tip of M_2 (Fig. 42)..................11. *quadrispinosa* n. sp.

ff. R_1 ends about opposite the forking of M.

g. Apical tooth of clasper placed near the mesal margin of the apex (Fig. 115); Species under 2.5 mm. Halteres dusky yellow, *varians* Joh.

gg. Apical tooth of clasper placed at apex (Fig. 108) or tooth wanting. (Fig. 123).

h. Halteres blackish; hind coxæ and legs brownish; claspers without apical tooth (Fig. 123); wing (Fig. 232). *jucunda* Joh.

hh. Halteres and coxæ yellowish; clasper with distinct apical tooth (Fig. 108).

i. Halteres and coxæ yellowish. Clasper with no subapical spines.

j. Petiole of cubitus about .6 as long as the basal section of M. (Fig. 227)..........................*prolifica* Felt.

jj. Petiole of cubitus over .8 as long as the basal section of M.

k. Wing veins heavily shaded (Fig. 228)....*prolifica* var. a

kk. Wing veins not shaded..................*prolifica* var. b.

ii. Halteres fuscous. Coxæ dull brown. Clasper (Fig. 18 a, b) with several subapical stout spines. Wing (Fig. 49). 18. *conglomerata* n. sp.

cc. R_1 ends at least one-sixteenth of the wing length proximad of the forking of M; the base of R_s is distad of the mid point between the humeral cross vein and the tips of R_1.

d. Fulvous mesonotum, abdomen more dusky; or reddish species.

e. Dusky red species, female 4 mm. long, halteres white; male not described..*sylvestrii* Kieffer

ee. Fulvous mesonotum, abdomen more dusky, length 2 mm. or less.

f. Clasper without strong spines at apex.

g. Tip of R_s ends far remote from apex of wing at a point on the costa about opposite the mid point of branch M_1 (Fig. 229). Clasper with several rather slender spines on the inner margin proximad of the mid point (Fig. 110).............*mellea* Joh.

gg. Tip of R_s ends rather remote from apex of wing, but at a point on the costa distad of the mid point of the branch of M_1. Clasper (Fig. 12) with about 5 stout spines and one longer, more slender spine at the middle of the inner margin. Wing (Fig. 43). 12. *luteola* n. sp.

ff. Clasper with one or more apical spines.

g. M_1 less than .8 as long as the petiole of the media. *tritici* Coquillett

gg. M_1 at least .9 as long as the petiole of the media.

h. Hypopygium with a median ventral lobe at base finely setose, clasper with single stout apical spine. (Fig. 13, a, b). Wing (Fig. 44)..................................13. *lobosa* n. sp.

hh. Hypopygium with no median ventral lobe at base, clasper with more than one apical spine (Fig. 265). *ocellaris* Comstock

dd. Black or fuscous species.

e. Clasper with a mesal articulated process (Fig. 112); R_s ends far remote from apex of wing. (Fig. 230)...............*hastata* Joh.

ee. Clasper without mesal articulated process.

f. Hypopygium near its base with one or two patches of setæ on or by the side of the median ventral line.

g. Hypopygium with one patch of setæ on the median ventral line near its base.

h. Clasper (Fig. 14, a, b) concave at apex, with at least two stout long spines, and over eight smaller spines on the margin of the concavity. Wing (Fig. 45).........14. *petaini* n. sp.

hh. Clasper of different form and structure.

i. Clasper with a terminal tooth.

j. Clasper blunt at apex. (Fig. 15, a, b). Wing (Fig. 46). 15. *grandis* n. sp.

jj. Clasper tapering at apex and with several prominent subapical spines.

k. Hypopygium with no more than 10 setæ on the basal median ventral line.

l. Costa extends about half the distance between the tips of R_s and M_1.

m. Wing of normal proportions (Fig. 47). Median ventral lobe of hypopygium distinct (Fig. 16, a, b). 16. *trifolii* n. sp.

mm. Wing narrow (Fig. 240). Median ventral lobe of hypopygium indistinct. Clasper (Fig. 120). *saliciæ* Joh.

ll. Costa extends about two-thirds the distance between the tips of R_s and M_1. (Fig. 117a)..*pauciseta* Felt.

kk. Hypopygium with more than 25 setæ on the basal median ventral line.

l. Abdomen variable dark ochreous, palpi yellow, anterior veins dark ochreous. ....*multiseta* Felt.

ll. Abdomen variable dark brown, palpi brown, anterior veins nearly black....................*agraria* Felt.

ii. Clasper without a terminal tooth (Fig. 123); the hypopygium with the setæ of the ventral median patch arranged in a transverse line (Fig. 123a). Halteres black. *jucunda* Joh.

gg. Hypopygium with 2 patches of setæ, one on each side of the median ventral line.

h. Clasper with subapical stout spines, the proximal one longest.

i. Clasper (Fig. 17 a, b) with 6 or more subapical stout spines, the most proximal one being longer than the others. Costa produced less than one-half the distance between the tips of R_s and M_1 (Fig. 48)....................17. *polychaeta* n. sp.

ii. Claspers (Fig. 18, a, b) with 3 or 4 subapical stout spines. Costa produced at least one-half the distance between the tips of R_s and M_1 (Fig. 49).........18. *conglomerata* n. sp.

hh. Clasper (Fig. 128) with no subapical stout spines. Costa produced over one-half the distance between the tips of R_s and M_1. Cu petiole at least half length of base of M (Fig. 247)...*scita* Joh.

ff. Hypopygium without a tuft of setæ on the median ventral line near the base, or if feeble tuft is present then petiole of cubitus is not under .6 as long as the basal section of media.

g. Claspers with 4 or 5 large subequal teeth or spines.

h. Distance from point on the costa opposite the base of R_s to the tip of R_1 less than the distance from the tip of R_1 to a point on the costa opposite the forking of the media.

i. Costa extends at least one-half the distance between the tips of R_s and M_1.

j. Clasper (Fig. 119) with one stout spine separate from the other 4 stout spines (Fig. 239)..*spinata* n. sp. (sp. 24 Joh.)

jj. Clasper with spines equidistant (Fig. 114). Wing (Fig. 234). *nacta* Joh.

ii. Costa extends less than one-half the distance between the tips of R_s and M_1 (Fig. 50). Clasper has no separate stout spine (Fig. 19)..............................19. *ovata* n. sp.

hh. Distance from point on the costa opposite the base of R_s to the tip of R_1 greater than the distance from the tip of R_1 to a point on the costa opposite the forking of the media. Wing (Fig. 233). Clasper (Fig. 113)..................*mutua* Joh.

gg. Claspers of different structure.

h. Petiole of cubitus short, less than one-half as long as basal section of M.

i. R_s ends distad of M_2; costa produced about one-half of distance from R_s to M_1. Mesonotum highly polished.

j. Halteres and coxæ bright yellow.(=*nigricans* Joh). *johannseni* End.

jj. Halteres fuscous, (Figs. 217, 260)..............*actuosa* Joh.

ii. Costa produced over one-half distance from R_s to M_1; if not, then R_s ends proximad of tip of M_2.

j. Clasper with 3 stout or several not stout apical teeth or spines.

k. Clasper with about 3 stout apical spines.

l. Distance from a point on the costa opposite the base of R_s to the tip of R_1 much less than the distance from the tip of R_1 to a point on the costa opposite the forking of media.

m. R_s ends on the costa opposite a point on M_1 proximad of the midpoint of M_1.

n. Costa extends less than one-half the distance between the tips of R_s and M_1 (Fig. 267). *cucumeris* Joh.

nn. Costa extends a little more than one-half the distance between the tips of R_s and M_1 (Fig. 241). *fatigans* Joh.

mm. R_s ends on the costa opposite a point on M_1 slightly distad of the midpoint of M_1. Costa extends less than one-half the distance between the tips of R_s and M_1 (Fig. 51). Clasper (Fig. 20). 20. *trifurca* n. sp.

ll. Distance from a point on the costa opposite the base of R_s to the tip of R_1 slightly greater than the distance from the tip of R_1 to a point on the costa opposite the forking of media (Fig. 52). Clasper (Fig. 21). 21. *pilata* n. sp.

kk. Clasper with more than three spines all of which are slender and not conspicuously distinguished from the setæ of the clasper...................*coprophila* Lint.

jj. Clasper without any or with only a single prominent apical or subapical tooth.

k. R_1 ends about opposite or only slightly proximad of the forking of M. (Fig. 255). Knob of halteres and coxæ brownish. Clasper (Fig. 115)......*varians* Joh. var c.

kk. R_1 ends considerably proximad of the forking of M.

l. Clasper globular or subglobular.

m. Thorax subopaque, not very shiny.

n. Clasper with a single stout spine, subapical in position. *longispina* n. sp. (Fig. 116). (Sp. 27 Joh.)

nn. Clasper with no stout spines (Fig. 22). Wing (Fig. 53)......................22. *ericia* n. sp.

mm. Thorax very shiny. Clasper subglobular. (Fig. 123).................................*lugens* Joh.

ll. Clasper not globular or subglobular.

m. Clasper with a stout apical or stout subapical spine.

n. Clasper with several subapical, slender, rather long spines (Fig. 131). R_s ends about opposite the tip of M_2 (Fig. 250). Mesonotum highly polished........................*acuta* Joh.

nn. Clasper with no subapical, slender, long spines. R_s ends considerably proximad of the tip of M_2 (Fig. 54).

o. Stout spine subapical (Fig. 67). (See plate, this key). Media forks distad of tip of Cu_2; R_s almost straight, only slightly curved at tip and usually distant from M_1....*hartii* Joh.

oo. Stout spine apical (Fig. 23).

p. Cu petiole less than half the length of the base of M. Distance from point on costa opposite the base of R_s to the tip of R_1 greater than the distance from the tip of R_1 to a point on costa opposite the forking of M. Branches of M considerably diverging. Wing (Fig. 54). Clasper (Fig. 23). 23. *penna*. n. sp.

pp. Cu petiole at least half the length of base of M. Distance from point on costa opposite the base of R_s to the tip of R_1 not greater than distance from tip of R_1 to a point on costa opposite the forking of M. Branches of M only slightly diverging. Wing (Fig. 56). Clasper (Fig. 25)...25. *hamata* n. sp.

mm. Clasper with no stout apical or subapical spine. Halteres luteous. Wing (Fig. 61). Clasper (Fig. 30). 30. *perfecta* n. sp.

hh. Petiole of cubitus at least half as long as the basal section of M.

i. R_s ends proximad of .85 of the length of the wing.

j. Clasper with 2 strong apical spines (Fig. 118). Wing veins strongly defined (Fig. 238). Thorax shining black. *parilis* Joh.

jj. Clasper and wing of different structure.

k. Costa produced less than two-thirds of distance from R_s to M_1.

l. Clasper with one or more stout apical spines.

m. Wing narrow (Fig. 240). Clasper with one stout apical spine; hypopygium with an indistinct basal cluster of setæ on the mid-ventral line (Fig. 120). *sativae* Joh.

mm. Wing wider (Fig. 267). Clasper with 3 apical spines; hypopygium with no trace of basal cluster of setæ on the mid-ventral line (Fig. 261). *cucumeris* Joh.

ll. Clasper with no stout apical spines, with one long slender subapical seta. (Fig. 24). Wing (Fig. 55). 24. *pollicis* n. sp.

kk. Costa produced over two-thirds from R_s to M1.

l. Clasper with two apical teeth (Fig. 121). Petiole of cubitus about three-fourths as long as basal section of M. Hind tarsus shorter than the tibia. *sp.-33* Joh.

ll. Clasper with a median process (Fig. 122). Petiole of the cubitus about half as long as the basal section of M. (Fig. 242). Hind tarsus and tibia subequal. *neglecta* Joh.

ii. R_s ends distad of .85 of wing length.

j. Clasper with one prominent terminal or subterminal spine or tooth, or if several teeth are present, one is conspicuously larger than the others.

k. Costa produced about one-half way from R_s to M_1.

l. Halteres bright yellow. Claspers (Fig. 125). Wing (Fig. 243). R_s ends distad of the tip of M_2. (=*nigricans* Joh.) *johannseni* End.

ll. Halteres fuscous. R_s ends opposite or proximad of the tip of M_2.

m. R_s ends about opposite the tip of M_2; Wing (Fig. 217). Mesonotum highly polished.......... *actuosa* Joh.

mm. R_s ends considerably proximad of the tip of M_2 (Fig. 56). Mesonotum shiny. Clasper (Fig. 25). 25. *hamata* n. sp.

kk. Costa produced over half way from R_s to M_1.

l. Costa produced over three-fourths way from R_s to M_1 (Fig. 244). Halteres yellow. Claspers (Fig. 126). S. *sp. 57* Joh.

ll. Costa produced less than .7 from R_s to M_1.

m. R_1 ends over one-fifth of wing length proximad of the forking of the media (Fig. 245). Halteres dark. Clasper (Fig. 127)............ *dolens* Joh.

mm. R_1 ends considerably less than one-fifth of wing length proximad of the forking of M.

n. Apex or near the apex of clasper with a number of spines of which one is somewhat larger or stouter than the others.

o. Halteres yellow. Clasper (Fig. 132). *diluta* Joh.

oo. Halteres dark. Clasper (Fig. 140). *diluta* Joh. var. a.

nn. Spine of apex of clasper distinctly differentiated from the apical setæ or from those near the apex.

o. Halteres yellow. Clasper with no subapical spines differentiated from the setæ of the clasper.

p. Costa produced less than five-eighths of the distance from R_s to M_1.

q. Hind tibia a little shorter than the tarsus. Wing (Fig. 216)............. *varians* Joh.

qq. Hind tibia and tarsus subequal in length. *varians*, var. a.

pp. Costa produced over two-thirds of distance from R_s to M_1.............. *varians*, var. b.

oo. Knobs of halteres fuscous.

p. Clasper (Fig. 26) with several long slender subapical spines, a little longer than the stout apical spine. The distance from the tip of R_1 to the point on the costa opposite the forking of M is greater than the distance between the tips of M_1 and M_2 (Fig. 57). 26. *felti* n. sp.

pp. Clasper (Fig. 27) with no long subapical spines. The distance between the tip of R_1 and the point on the costa opposite the forking of M is not greater than the distance between the tips of M_1 and M_2. Wing. (Fig. 58)....27. *macroptera* n. sp.

jj. Clasper with two or more prominent apical teeth, spines, or with strong setæ.

k. Clasper with two or three apical or subapical spines. Knobs of halteres black or brown.

l. Black species 3 mm. in length, with blackish legs. Clasper subglobose (Fig. 128)..........*scita* Joh.

ll. Smaller species with fuscous yellowish legs. Claspers more slender.

m. Spines of clasper unusually short (Fig. 129). The distance from the tip of R_1 to the point on the costa opposite the forking of M is greater than the distance between the tips of M_1 and M_2. *fumida* Joh.

mm. Spines of clasper not unusually short. The distance from the tip of R_1 to the point on the costa opposite the forking of M is less than the distance between the tips of M_1 and M_2.

n. Clasper (Fig. 130) with three or four slender subequal spines, two or three near the apex, the other near the apical third, all on the inner margin. Petiole of cubitus about as long as or longer than the base of media (Fig. 249). *tricialis* Joh.

nn. Clasper (Fig. 28) with three rather stout subequal spines, all clustered at the apex. Petiole of cubitus much shorter than the base of media (Fig. 59)..................28. *subtricialis* n. sp.

kk. Clasper with five or more apical and subapical setae or spines.

l. Apex of clasper with six or eight spines, one of which is set at an angle to the others. (Fig. 137). Halteres yellow. Wing (Fig. 252)............*impatiens* Joh.

ll. Apex of clasper with spines or setæ subequal in size and distance from each other.

m. Clasper with about six stout conspicuous subequal spines (Fig. 29). Wing (Fig. 60). 29. *sexdentata* n. sp.

mm. Clasper with no conspicuous or stout spines.

n. M_2 distinctly shorter than length of petiole of media. Coxæ yellowish. (Fig. 133). *coprophila* Lint.

nn. M_2 about equal in length to the petiole of media. Coxæ brown or black. Wing (Fig. 62). Clasper (Fig. 31). (Compare *caldaria* Lint.) *caldaria* var.

SCIARA.

1. **Sciara forceps** n. sp.

Male: Length, 1.6 mm. Head black, shiny; palpi and scape of antennæ luteous, antennæ broken. Thorax; mesonotum shiny, black; humeri and pleura of prothorax luteous; metanotum and pleuræ of meso and metathorax fuscous. Abdomen dark fuscous with posterior third of the abdominal segments and venter luteous; hypopygium light brown; clasper (Fig. 1) with several stout apical spines, one slightly stouter than the rest, and one very prominent large, subapical spine, giving the clasper a bifurcated appearance. Coxæ and femora luteous, trochanters black, tibiæ and tarsi fuscous. Wings (Fig. 32) hyaline; media and cubitus setose; base of R_s noticeably distad of the midpoint between the humeral cross vein and the tip of R_1; R_1 ends noticeably proximad of the forking of media; petiole of cubitus distinctly longer than the base of media; costa extends over half the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing and slightly proximad of the tip of M_2. Halteres; pedicel luteous, knobs darker.

This species is closely related to *dives*, but may be distinguished from the latter by the characters of the clasper, the color of the body and the fact that the petiole of the media is setose.

Described from 1 male collected May 3, 4, 1916, at Palatka, Florida, by J. C. Bradley. Type No. 207.

2. **Sciara multisetifera** n. sp.

Male: Length, 2.8 mm. Head piceous to black; antennæ of dried specimen half as long as body, piceous to black. Thorax, abdomen piceous to black, the posterior margins of the second, third and fourth abdominal segments grayish. Angles of humeri dull luteous. Appendages, including palpi, halteres, legs and hypopygium fuscous. Hypopygium; clasper (Fig. 2) with many setæ shorter than the numerous slender spines along the inner margin. Wings (Fig. 33) smoky brown; media branches setose; base of R_s noticeably distad of the midpoint between the humeral cross vein and the tip of R_1; R_1 ends proximad of the forking of media; petiole of cubitus distinctly longer than the base of media; costa extends about half the distance between the tips of R_s and M_1; R_s ends far distad of .85 the length of the wing and distad of the tip of M_2.

This species differs from *cylindrica*, its near relative, by having many more setæ on the clasper, all of which are shorter than those on the inner margin.

Described from 3 males, collected in South Arizona, Aug., 1902, by F. H. Snow. Type No. 208. Two allotypes.

3. **Sciara cylindrica** n. sp.

Male: Length, 1.5 mm. Head shiny black; antennæ almost black; palpi almost black. Thorax shiny black. Abdomen and hypopygium almost black. Hypopygium; clasper (Fig. 3) as wide at the apex as at the middle, setæ longer than the about 8 rather slender spines of the inner margin. Coxæ dull luteous, femora, tibiæ and tarsi fuscous. Wings (Fig. 34) hyaline, media and cubitus setose; base of R_s slightly distad of the midpoint between the humeral cross vein and the tip of R_1; R_1 ends proximad of the forking of media; petiole of cubitus evanescent, apparently less than half the length of the base of media; costa extends about two-thirds the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing, and slightly proximad of the tip of M_2. Halteres luteous with dark knob.

This species may be distinguished from its near relatives, *congregata*, *psittacus*, and *cylindrica* by the form of the clasper and by the petiole of cubitus being shorter than the base of media.

Described from 1 male, collected May 15–19, 1907, at Felton, St. Cruz Mts., Cal., by J. C. Bradley, Type No. 209.

4. **Sciara congregata** Joh.

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Male: Length, 2 mm. Head black; antennæ fuscous, short (about two-thirds as long as wing from humeral cross vein), joints not twice as long as wide; palpi fuscous. Mesonotum subshining blackish; scutellum, metanotum and pleura subopaque, brownish black. Abdomen subopaque, brownish black. Hypopygium brownish black; no median ventral setiferous lobe; claspers resemble those of *jucunda*, but apical setæ are stouter. Legs brown, the tarsi darker; hind tibia about as long as the petiole of the media of the wing; apical third of tibiæ slightly broadened; hind tarsus about .8 as long as the tiba, hind metatarsus slightly over .7 as long as the following 4 joints. Wings (Fig. 35) smoky; veins dark brown, forks of media and apical part of forks of cubitus setose; R_1 ends one-third as far proximad of the forking of media as the tip of R_s is distad of this point; basal section of R_s very faint but is evidently distad of the midpoint between the humeral cross vein and the tip of R_1; petiole of cubitus slightly longer than the basal section of M; media petiole is indistinct; costa produced half of the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing and slightly proximad of the tip of M_2. Halteres dark.

Female: Length, 2.5 mm. Like the male in coloring and structure, differing in having slightly shorter antennæ, these being less than one-half as long as the wing, with intermediate joints but little longer than wide; the basal section of R_s and the petiole of media a little more distinct. The lamellæ of the ovipositor are only slightly longer than wide.

Type in Dr. Johannsen's collection, Cornell University. Paratypes in the collection of the Arkansas Exp. Station.

5. **Sciara psittacus** n. sp.

Male: Length, 1.9 mm. Head fuscous; antennæ fuscous, scape luteous; palpi fuscous. Thorax fulvous. Abdomen fuscous with posterior margin of each segment and the whole of the venter luteous. Hypopygium fulvous, clasper (Fig. 5) distinctly narrower at apex than the middle, with the comparatively few setæ on the surface longer than the numerous slender spines along the inner margin. Coxæ and femora luteous, trochanters black; tibiæ and tarsi fuscous. Wings (Fig. 36) hyaline; media and cubitus setose; the petiole of media evanescent or very faint; base of R_s considerably distad of the midpoint between the humeral cross vein and the tip of R_1; R_1 ends considerably proximad of the forking of media; petiole of cubitus about as long as the base of media, costa extends about half the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing and about opposite the tip of M_2. Halteres luteous.

Described from 1 male collected in Maine, Aug. 21, 1913, by C. P. Alexander. Type No. 210.

6. **Sciara habilis** var.

Male: Length, 2.4 mm. Head black; antennæ fuscous with dull fulvous scape; palpi fuscous. Thorax subshining, black, covered with a fine, whitish powder. Abdomen and hypopygium almost black. Hypopygium; clasper (Fig. 6) narrower at apex than middle, the setæ as long or longer than the numerous rather short spines along the inner margin. Coxæ and femora luteous; trochanters black, tibiæ and tarsi fuscous. Wings (Fig. 37) hyaline; media and cubitus setose; base of R_s about at the midpoint between the humeral cross vein and the tip of R_1; R_1 ends slightly distad of the forking of media; petiole of cubitus less than one-fourth the length of the base of media; costa extends two-thirds the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing and very slightly proximad of the tip of M_2. Halteres luteous.

This variety differs from *Sciara habilis*, by having more subequal spines along the inner margin, and by the fact that *habilis* is larger.

Described from one male, collected at Clayton, Ga., May 18-26, 1911. Type No. 211.

7. **Sciara globosa** n. sp.

Male: Length, 3.2 mm. Head black, shiny; antennæ fuscous with the two basal segments fulvous; palpi fuscous. Thorax shiny, dark fuscous with angles of humeri fulvous. Abdomen dark fuscous, with posterior third of each segment black. Hypopygium dark fuscous; clasper (Fig. 7) subglobose, with about 6 stout subapical spines surrounded by short setæ. Coxæ, femora, tibiæ and tarsi fuscous, trochanters black. Wings (Fig. 38) smoky brown; media and cubitus setose; base of R_s about at the mid-point between the humeral cross vein and the tip of R_1; R_1 ends distad of the forking of media; petiole of cubitus less than one-fourth the length of the base of media; costa extends about two-thirds the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing and slightly proximad of the tip of M_2. Halteres fuscous.

This species is similar to both *habilis* and *serrosa*, but differs from both by having a subglobose clasper, and by having dark coxæ and halteres.

Described from 1 male, collected at Muir Woods, Cal., Aug. 30, 1908, by J. C. Bradley, Type No. 212.

NEOSCIARA.

(New genus.)

8. **Neosciara falcata** n. sp.

Male: Length, 2.3 mm. Head black; antennæ: flaggelum black, scape luteous; palpi luteous. Thorax; mesonotum and metanotum fulvous, not shiny, pleura fuscous. Abdomen fuscous. Hypopygium brown, with a basal median ventral lobe (Fig. 8, b) on which are about 14 prominent spines arranged in 2 rather indistinct rows; clasper (Fig. 8, a) with an apical spine and no subapical spines. Legs: coxæ and femora luteous; trochanters, tibiæ and tarsi fuscous. Wings (Fig. 39) hyaline; media and cubitus without setæ; base of R_s at the mid-point between the humeral cross vein and the tip of R_1; R_1 ends slightly (not more than one-tenth the wing length) proximad of the base of the fork of M; petiole of cubitus over half the length of the base of media; costa extends over half the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing and about opposite the tip of M_2. Halteres luteous.

This species is related to *fulvicauda* but is easily separated from the latter by the structure of the clasper and the longer petiole of cubitus.

Described from one male, collected at Auburndale, Mass., April, 1916. Type No. 213.

9. **Neosciara fochi** n. sp.

Male: Length, 2.5 mm. Head black; antennæ missing; palpi missing. Thorax shiny, black. Abdomen fuscous to black. Hypopygium fuscous, with 2 clusters of prominent spines at the base, one on each side of the mid ventral line (Fig. 9b); clasper (Fig. 9a) with 2 apical stout spines and no subapical spines. Legs fuscous to black. Wings (Fig. 40) smoky; media and cubitus without setæ; base of R_s at the mid-point between the humeral cross vein and the tip of R_1; R_1 ends slightly (not more than one-tenth of the wing length) proximad of the forking of M; petiole of cubitus a little longer than the base of media;

costa extends a little over half the distance between the tips of R_s and M_1; R_s ends slightly distad of .85 the length of the wing, and noticeably proximad of the tip of M_2. Halteres fuscous.

Described from 1 male, collected near Leander, Wyoming, August, by Roy Moodie, at an elevation of 5,000 to 8,000 feet. Type No. 214.

10. **Neosciara joffrei** n. sp.

Male: Length, 2.5 mm. Head dull, black; antennæ fuscous, over half the length of the body; palpi fuscous. Thorax shining, dark fuscous. Hypopygium with no median ventral lobe at base, fuscous; clasper (Fig. 10) conical, with 2 apical subequal stout spines and 1 subapical longer more slender spine. Legs fuscous. Wings (Fig. 4) hyaline; media and cubitus without setæ; base of R_s at the midpoint between humerus and the tip of R_1; R_1 ends about opposite the forking of media; petiole of cubitus over half the length of the base of media; costa extends over two-thirds the distance between the tips of R_s and M_1; R_s ends slightly distad of .85 the length of the wing and proximad of the tip of M_2. Halteres fuscous.

This species is similar to *fochi*, but differs in structure and shape of the clasper, the shorter petiole of cubitus, and the longer costa.

Described from one male, collected at North Mt., Pa., June 7. Type No. 215.

11. **Neosciara quadrispinosa** n. sp.

Male: Length, 2.6 mm. Head shiny, black; antennæ piceous, over half the length of the body; palpi piceous. Thorax shiny, piceous to black. Abdomen piceous, the anterior half of the intermediate segments brown. Hypopygium brown, with no median ventral lobe at the base; clasper (Fig. 11) circular, with 4 long conspicuous stout spines at the apex, no subapical spines. Coxæ, femora and tibiæ luteous, tarsi fuscous. Wings (Fig. 42) smoky; media and cubitus without setæ; base of R_s at the mid-point between the humeral cross vein and the tip of R_1; R_1 ends distad of the forking of media; petiole of cubitus less than half the length of the base of media; costa extends at least two-thirds the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing and about opposite the tip of M_2. Halteres: knobs fuscous, pedicels luteous.

This species differs from *dux* and *imitans*, by having no mesal process on the clasper and by having R_s end opposite the tip of M_2.

Described from one male collected at North Adams, Mass., March 20. Type No. 216.

12. **Neosciara luteola** n. sp.

Male: Length, 1.5 mm. Head luteous; antennæ about as long as body, fuscous with scape luteous; segments at least twice as long as wide; palpi luteous. Thorax luteous, shining. Abdomen; dorsum brownish with posterior margin of each segment luteous; venter luteous. Hypopygium luteous, with no median ventral lobe at base; clasper (Fig. 12) with 5 or 6 subapical stout spines and one more slender slightly longer spine, one or two of the most proximad spines points more cephalad than the rest, several very small setæ proximad of the stout spines. Legs luteous, trochanters black. Wings (Fig. 43) hyaline; media and cubitus without setæ; base of R_s slightly distad of the mid-point between the humeral cross vein and the tip of R_1; R_1 ends proximad of the forking of media; petiole of cubitus less than half the length of the base of the media; costa extends a little over half the distance between the tips of R_s and M_1; R_s ends slightly proximad of .85 the length of the wing and proximad of M_2. Halteres luteous.

This species is closely related to *mellea*, but differs in the structure of the clasper and the color of the body.

Described from 2 males collected at Black Rock, Rabun Co., Ga., May 20-23, 1911. Type No. 217, and one paratype.

13. **Neosciara lobosa** n. sp.

Male: Length, 1.5 mm. Head fuscous, not shiny; antennæ with fuscous flagelium and fulvous scape; palpi fulvous. Thorax subshining, fulveus, with a broad median dorsal indistinct fuscous line on the mesonotum. Abdomen fuscous. Hypopygium fuscous, at base with a median ventral lobe covered with minute setæ (Fig. 13b); clasper (Fig. 13a) with a large apical spine and no subapical spines. Legs: coxæ luteous, trochanters fuscous, tibiæ fulvous, tarsi fuscous. Wings (Fig. 44) hyaline; media and cubitus without setæ; base of R_s distad of the mid-point between the humerus and the tip of R_1; R_1 ends distinctly proximad of the forking of media; petiole of cubitus over half the length of the base of media; costa extends a little over half the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing and about opposite the tip of M_2. Halteres; knobs fuscous, pedicels luteous.

This species differs from *ocellaris* by having a median ventral lobe on the hypopygium, and a clasper with only one apical spine.

Described from one male, collected at Carbonate, Columbia River, British Columbia, July 7-12, 1908, by J. C. Bradley, at an altitude of 2,600 feet. Type No. 218.

14. **Neosciara petaini** n. sp.

Male: Length, 1.6 mm. Head black, somewhat shining; antennæ fuscous, about two-thirds the length of the body, segments of flagellum at least twice as long as wide, distal segments more than twice as long as wide; palpi fulvous. Thorax fuscous, somewhat shining. Abdomen fuscous. Hypopygium fuscous, with a cluster of about 10 broad setæ much larger than the surrounding setæ (Fig. 14b) at base on the mid ventral line; clasper (Fig. 14a) concave, at apex, with about 2 very stout spines and at least 10 smaller spines on the margin of the concavity. Legs fulvous, tibiæ and tarsi darker. Wings (Fig. 45) hyaline; media and cubitus with no setæ; base of R_s distad of the mid-point between the humeral cross vein and the tip of R_1; R_1 proximad of the forking of M; petiole of cubitus about as long as the basal section of M; costa extends a little over half the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing and about opposite the tip of M_2. Halteres fuscous.

Described from one male collected in Maryland, May 14, 1909. Type No. 219.

15. **Neosciara grandis** n. sp.

Male: Length, 2 mm. Head black; antennæ and palpi fuscous; antennæ as long as head and thorax. Thorax black, shining; humeri angles fuscous. Abdomen dark fuscous, posterior margins of segments black. Hypopygium (Fig. 15b) dark fuscous, with a patch of about 6 setæ at the base on the median ventral line; clasper (Fig. 15a) blunt at apex with one stout apical spine and no distinct subapical spines. Coxæ and femora fulvous, trochanters black, tibiæ brown, tarsi fuscous. Wings (Fig. 46) hyaline; media and cubitus without setæ; base of R_s at about the midpoint between the humeral cross vein and the tip of R_1; R_1 ends proximad of the forking of M; petiole of cubitus not quite half as long as the base of media; costa produced more than half the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing and about opposite the tip of M_2. Halteres fulvous.

This species differs from *trifolii* and *pauciseta* by having no prominent subapical spines on the clasper.

Described from one male, collected July 13, 1913, on Lost Mount, Cobb Co., Georgia. Type No. 220.

16. **Neosciara trifolii** n. sp.

Male: Length, 1.2 mm. Head black; antennæ fuscous, over two-thirds the length of the body. Thorax; mesonotum piceous, shiny, pleuræ fuscous. Abdomen black, intermediate segments with anterior two-thirds fuscous, hairs pale yellow; hypopygium brown, near its base with a small median ventral lobe (Fig. 16b) margined with about 8 setæ; clasper (Fig. 16a) with an apical tooth, and with about 4 stout, subequal, scattered spines, and with one proximad, longer, more slender spine along the inner margin. Coxæ and palpi luteous; trochanters black; tibiæ dull yellowish-brown; tarsi fuscous to black; hind tibia and tarsus about equal in length. Wings (Fig. 47) hyaline; veins brown, rather strongly marked; media and cubitus without setæ; petiole of cubitus slightly less than half the length of the base of media; R_1 ends at least one-sixteenth of the wing length proximad of the forking of M; the base of R_s distad of the mid-point between the humeral cross vein and the tip of R_1; M_2 ends distad of the termination of R_s. Twin Falls, Moscow, Idaho.

Female: Length, 1.5 mm. Colored like the male. Moscow, Idaho.

This species is closely related to *pauciseta* Felt., from which it may be distinguished by the characters of the hypopygium and the more retracted position of the tip of R_s.

Described from 2 males reared by Professor Burrill, Oct. 27, 1916, and Oct. 3, 1917, and 10 females reared Oct. 27, 1916, from the heads of red clover, Moscow, Idaho. Type No. 221.

17. **Neosciara polychæta** n. sp.

Male: Length, 1.2 mm. Head black; antennæ dark fuscous, over two-thirds the length of the body, scape fulvous, palpi luteous. Thorax black shining. Abdomen fuscous to black; hypopygium fuscous, with 2 patches of setæ at base (Fig. 17b), one on each side of the median ventral line; clasper (Fig. 17) with one large apical spine and about 6 subapical smaller but stout spines, the most proximal one being longer and more slender than the others. Coxæ luteous, trochanters black, femora dull luteous, tibiæ brown, tarsi fuscous. Wings (Fig. 48) hyaline; media and cubitus without setæ; base of R_s far distad of the mid-point between the tip of R_1 and the humeral cross vein; R_1 ends noticeably proximad of the forking of media; petiole of cubitus over half as long as the base of media; costa produced less than half the distance between the tips of R_s and M_1; R_s ends distad of .85 the wing length, and about opposite the tip of M_2. Halteres luteous.

Female: Length, 1.4 mm. Same as male, except the antennæ which have a black scape and are no more than half the length of the body.

Described from 5 males and 1 female collected at Clayton, Georgia, May 18–26, 1911. Type No. 222. Four paratypes and one allotype.

18. **Neosciara conglomerata** n. sp.

Male: Length, 1.8 mm. Head black; antennæ black, not quite one-half the length of the body. Thorax black, dull, covered with a fine white powder. Abdomen fuscous, the posterior margin of each segment luteous. Hypopygium fuscous, with 2 patches of setæ at the base, one on each side of the median ventral line (Fig. 18b); clasper (Fig. 18a) with one large apical spine and about 3 subapical, subequal spines and one subapical long, slender spine proximal to the others. Coxæ dull brown, trochanters fuscous, femora and tibiæ dull fulvous, tarsi almost black. Wing (Fig. 49) hyaline; media and cubitus without setæ; base of R_s distad of the mid-point between the tip of R_1 and the humeral cross vein; R_1 ends proximad of the forking of media; petiole of cubitus is a little over one-half as long as the base of media; costa produced more than one-half the distance between the tips of R_s and M_1; R_s is about parallel with costa and ends distad of .85 of the wing length and about opposite the termination of M_2. Halteres fuscous.

Female: Length, 2.2 mm. Same as male except that in one specimen the venter is dull luteous in color.

Described from 4 males and 4 females collected June 20-27, 1907, at Blue Lake, Humboldt Co., Cal., by J. C. Bradley. Type No. 223. Three paratypes and 4 allotypes.

19. **Neosciara ovata** n. sp.

Male: Length, 1.1 mm. Head black, somewhat shining; antennæ fuscous, at least half the length of the body; palpi fuscous. Thorax fuscous to black, subshining. Abdomen fuscous, intermediate segments dull luteous along the posterior margin. Hypopygium fuscous, no cluster of setæ at base on median ventral line; clasper (Fig. 19) oval with 4 or 5 stout subequal spines near or at the apex. Legs dull fulvous. Wings (Fig. 50) hyaline; media and cubitus without setæ; base of R_s distad of the mid-point between the humerus and the tip of R_1; R_1 ends considerably proximad of the forking of M; petiole of cubitus shorter than half the length of the base of M; costa extends less than half the distance between the tips of R_s and M_1; R_s ends slightly proximad of .85 the length of the wing and distinctly proximad of the tip of M_2. Halteres fuscous.

This species is closely related to *spinata*, but differs in the structure of the clasper and the shorter petiole of cubitus.

Described from one male collected at Howser, Selkirk Mts., British Columbia, June 22, 1905, by J. C. Bradley. Type No. 224.

20. **Neosciara trifurca** n. sp.

Male: Length, 1 mm. Head somewhat shining, black; antennæ fuscous, about as long as the body; palpi fuscous. Thorax somewhat shining, fuscous. Abdomen almost black. Hypopygium fuscous with no cluster of setæ at base on the mid-ventral line; clasper (Fig. 20) oval, with about 3 subequal, apical stout spines and no subapical spines, several small setæ along the inner margin. Legs: coxæ, femora and tibiæ dull fulvous, trochanters black, tarsi fuscous. Wings (Fig. 51) hyaline, media and cubitus without setæ; base of R_s distad of the mid-point between humerus and the tip of R_1; R_1 ends far proximad of the forking of M; petiole of cubitus shorter than half the length of the base of M; costa extends less than half the distance between the tips of R_s and M_1; R_s ends slightly proximad of .85 the length of the wing and considerably proximad of the tip of M_2. Halteres fuscous.

This species is near *fatigans* in the key, but differs by having fuscous halteres, a shorter costa and a shorter cubitus petiole.

Described from one male, collected at Felton, St. Cruz Mts., Cal., May 15–19, 1907, by J. C. Bradley. Type No. 225.

21. **Neosciara pilata** n. sp.

Male: Length, 1.4 mm. Head somewhat shining, black; antennæ fuscous; palpi luteous. Thorax somewhat shining, almost black. Abdomen dark fuscous. Hypopygium fuscous, with no cluster of setæ on the mid-ventral line at base; clasper (Fig. 21) conical, with 3 apical stout spines, no subapical spines, and several small setæ on the inner margin. Legs: coxæ and femora luteous, trochanters black, tibiæ fulvous; tarsi fuscous. Wings (Fig. 52) hyaline; media and cubitus without setæ; base of R_s distad of the mid-point between humerus and the tip of R_1; R_1 ends far proximad of the forking of M; petiole of cubitus a little less than half the length of the base of M; costa extends more than half the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing and slightly proximad of the tip of M_2. Halteres; knobs fuscous, pedicels luteous.

This species is very similar to *trifurca*, but differs in size, in the longer costa and cubitus petiole, and in the position of R_2 in relation to that of M_2.

Described from one male, collected at Felton, St. Cruz Mts., Cal., May 15–19, '07, by J. C. Bradley. Type No. 226.

22. **Neosciara ericia** n. sp.

Male: Length, 2.9 mm. Head black, somewhat shiny; antennæ fuscous, about two-thirds the length of the body; palpi fuscous. Thorax fuscous, somewhat shiny. Abdomen almost black. Hypopygium fuscous, with no cluster of setæ on the mid-ventral line at base; clasper (Fig. 22) globose, with no stout spines. Legs: coxæ fulvous, femora and tibiæ brown, tarsi fuscous. Wings (Fig. 53) hyaline; cubitus and media with no setæ; base of R_s distad of the mid-point between the humerus and the tip of R_1; R_1 proximad of the forking of media; petiole of cubitus much less than half the length of the basal section of M; costa extends over two-thirds the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing, and about opposite the tip of M_2. Halteres fuscous.

This species is near *longispina* in the key, but differs by having no stout spine on the clasper, and by having a shorter cubitus petiole.

Described from one male collected at Brookline, Mass., by C. W. Johnson. Type No. 227.

23. **Neosciara penna** n. sp.

Male: Length, 1.1 mm. Head black, somewhat shiny; antennæ fuscous, over half the length of the body; palpi luteous. Thorax somewhat shining, almost black. Abdomen dark fuscous with posterior margin of the intermediate segments dull luteous. Hypopygium fuscous, with no cluster of setæ on the mid-ventral line at the base; clasper (Fig. 23) narrowly oval, with one apical stout spine and no subapical spines. Legs; coxæ and femora luteous, trochanters black, tibiæ and tarsi fuscous. Wings (Fig. 54) hyaline; media and cubitus without setæ; base of R_s distad of the mid-point between the humerus and the tip of R_1; R_1 ends considerably proximad of the forking of M; petiole of cubitus shorter than half the length of the base of M; costa extends more than half the distance between the tips of R_s and M_1; R_s ends slightly proximad of .85 the length of the wing and considerably proximad of M_2. Halteres, knob fuscous, pedicel luteous.

This species is near *acuta* in the key but differs from the latter by having no subapical spines on the clasper and by having R_s end proximad of the tip of M_2. Type No. 228.

Described from one male, collected at Blue Lake, Humboldt Co., Cal., June 20-27, by J. C. Bradley.

24. **Neosciara pollicis** n. sp.

Male: Length, 1.4 mm. Head somewhat shiny, black; antennæ fuscous, about half the length of the body; palpi fuscous. Thorax somewhat shining, fuscous. Abdomen almost black. Hypopygium fuscous, with no cluster of setæ on the mid-ventral line at base; clasper (Fig. 24) longer than wide, with no stout spines, but with a subapical long seta. Legs: coxæ and femora fulvous, trochanters black; tibiæ and tarsi dull brown. Wings (Fig. 55) brownish; cubitus and media without setæ; base of R_s distad of the mid-point between the humerus and the tip of R_1; R_1 ends proximad of the forking of M; petiole of cubitus almost as long as the base of media; costa extends a little over half the distance between the tips of R_s and M_1. R_s ends proximad of .85 the length of the wing and noticeably proximad of the tip of M_2. Halteres dark fuscous.

This species is near *sativæ* and may be distinguished from the latter especially by having a wider wing and by the clasper lacking spines.

Described from one male collected in Arizona, August. Type No. 229.

25. **Neosciara hamata** n. sp.

Male: Length, 1.2 mm. Head shining, black; antennæ fuscous; palpi fuscous. Thorax shiny, almost black. Abdomen almost black. Hypopygium almost black, with no cluster of setæ on the mid-ventral line at base; clasper (Fig. 25) at least twice as long as wide, with one large apical spine, and no subapical spines. Legs fuscous; the front coxæ fulvous. Wings (Fig. 56) hyaline; cubitus and media with no setæ; base of R_s considerably distad of the mid-point between humerus and the tip of R_1; R_1 ends far proximad of the forking of M; petiole of cubitus a little longer than half the length of the base of media; costa extends about half the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing, and noticeably proximad of the tip of M_2. Halteres fuscous.

This species is near *actuosa* in the key, but differs especially in the form of the clasper, which is longer, narrower and more blunt at the tip.

Described from one male, collected by J. C. Bradley at Black Rock Mt., Georgia, at an altitude of 3,500 feet, May 20-25, 1911. Type No. 230.

26. **Neosciara felti** n. sp.

Male: Length, 1 mm. Head shiny black; antennæ dark fuscous; palpi fuscous. Thorax shiny black. Abdomen dark fuscous. Hypopygium fuscous, with no cluster of setæ on the mid-ventral line at base; clasper (Fig. 26) about twice as long as wide, with one very stout apical spine, and about 5 more slender subapical spines, the most proximad of which is longer and more slender than the others. Legs: coxæ and femora fulvous to luteous, trochanters black, tibiæ and tarsi fuscous. Wings (Fig. 57) hyaline; media and cubitus without setæ; base of R_s far distad of the mid-point between humerus and the tip of R_1; R_1 ends far proximad of the forking of M; petiole of cubitus over half as long as the basal section of media; costa extends about two-thirds the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing and between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing and about opposite the tip of M_2. Halteres fuscous.

Described from one male collected at Ithaca, N. Y., July 9, 1904. Type No. 231.

27. **Neosciara macroptera** n. sp.

Male: Length, 1.5 mm. Head somewhat shining, black, antennæ fuscous; palpi fuscous. Thorax somewhat shiny, fuscous. Abdomen almost black. Hypopygium fuscous, with no cluster of setæ on the mid-ventral line at base; clasper (Fig. 27) at least twice as long as wide, with one stout apical spine and about 8 subequal much smaller subapical spines on the inner margin. Legs; coxæ fulvous, trochanters black, femora, tibiæ and tarsi fuscous. Wings (Fig. 58) hyaline, with no setæ on the media and cubitus; base of R_s considerably distad of the mid-point between humerus and the tip of R_1; R_1 ends proximad of the forking of M; petiole of cubitus a little over half the length of the base of media; costa extends a little over half the distance between the tips of R_s and M_1; R_s ends slightly distad of .85 the length of the wing and distinctly proximad of the tip of M_2. Halteres; knobs fuscous, pedicels luteous.

This species differs from *felti* by having a clasper with no *long* subapical spines.

Described from one male collected by J. C. Bradley at Felton, St. Cruz Mts., Cal., May 15–19, at an elevation of 300–500 feet. Type No. 232.

28. **Neosciara subtrivialis** n. sp.

Male: Length, 1.5 mm. Head somewhat shining, black; antennæ fuscous, a little over half the length of the body; palpi fulvous. Thorax somewhat shiny, fuscous. Abdomen fuscous. Hypopygium fuscous, with no cluster of setæ on the mid-ventral line at base; clasper (Fig. 28) at least twice as long as wide, with about 3 stout apical spines, no subapical spines, and several minute subapical setæ along the inner margin. Legs: coxæ and femora dull fulvous, trochanters black, tibiæ and tarsi fuscous. Wings (Fig. 59) hyaline, media and cubitus without setæ; base of R_s distad of the mid-point between humerus and the tip of R_1; R_1 ends far proximad of the forking of M; petiole of cubitus about half as long as the basal section of M; costa extends about two-thirds the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing and slightly proximad of the tip of M_2. Halteres; knobs fuscous, pedicels luteous.

This species is near *trivialis* in the key, differing from the latter by having 3 stout apical spines on the clasper and a shorter cubitus petiole.

Described from 2 males, collected at Berkeley, Cal., Oct. 31, 1906, by J. C. Bradley. Type No. 233. One holotype and one paratype.

29. **Neosciara sexdentata** n. sp.

Male: Length, 2 mm. Head black, not shining; antennæ fuscous, half the length of the body; palpi luteous. Thorax not shiny, almost black. Abdomen dark fuscous. Hypopygium fuscous, with no cluster of setæ on the mid-ventral line at base; clasper (Fig. 29) about twice as long as wide at widest part, about 6 apical stout spines and no subapical spines, several minute subapical setæ. Legs: coxæ fulvous; femora, tibiæ and tarsi fuscous; trochanters black. Wings (Fig. 60) hyaline; cubitus and media with no setæ; base of R_s distad of the mid-point between the humerus and the tip of R_1; R_1 proximad of the forking of M; petiole of cubitus almost as long as the basal section of media; costa extends about half the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing, and slightly proximad of the tip of M_2. Halteres; knobs fuscous, pedicels luteous.

This species is near *impatiens* in the key, and differs from the latter by having no spine separated from the rest on the clasper, and a more retracted costa.

Described from one male collected at Santa Paula, Cal. Type No. 234.

30. **Neosciara perfecta** n. sp.

Male: Length, 1.8 mm. Head black, somewhat shiny; antennæ fuscous, about half the length of the body, segments of flagellum not twice as long as wide except at tip; palpi fulvous. Thorax somewhat shining, fuscous. Abdomen fuscous. Hypopygium fuscous, with no cluster of setæ on the mid-ventral line at the base; clasper (Fig. 30) with numerous comparatively short setæ at the apex, and with no stout spines. Legs fulvous, tibiæ and tarsi fuscous. Wings (Fig. 61) hyaline; cubitus and media without setæ; base of R_s distad of the mid-point between the humeral cross vein and the tip of R_1; R_1 ends proximad of the forking of M; petiole of cubitus a little less than half the length of the basal section of M; costa extends about two-thirds the distance between the tips of R_s and M_1; R_s ends distad of .85 the length of the wing, and proximad of the tip of M_2. Halteres luteous.

This species is near *coprophila* in the key, but differs from the latter especially by having a shorter cubitus petiole, yellow halteres, and shorter apical setæ on the clasper.

Described from one male specimen collected in Maryland, April 12, 1914. Type No. 235.

New Species of Sciarids from South America.

By F. W. Pettey, Cornell University, Ithaca, N. Y.

Sciara paradoxa n. sp.

Male: Length, 2.8 mm. Head black; antennæ and palpi black. Thorax black, somewhat shining, with whitish powdery covering. Abdomen black. Hypopygium black, with no cluster of setæ on the mid-ventral line at base; clasper (Fig. 65) at least twice as long as wide, with one large and about 4 smaller but stout apical spines, and one larger subapical spine. Legs: coxæ black, femora and tibiæ dark fuscous, tarsi black. Wings (Fig. 64) smoky brown, with cubitus and media setose and second anal vein indicated by a row of setæ; base of R_s at about the mid-point between the humeral cross vein and the tip of R_1; R_1 ends opposite or slightly distad of the forking of M; petiole of cubitus one-third of its length longer than the basal section of M; costa extends about one-third the distance between R_s and M_1; R_s ends considerably distad of .85 the length of the wing, and slightly proximad of the tip of M_2. Halteres black.

This species possesses a structural character unknown to the writer in any other species of Sciara, *i. e.*, a row of setæ forming apparently a second anal vein.

Described from 3 males collected at Valle de Papas, Caqueta, Columbia, South America, March, 1912. Type No. 237. Two paratypes. Cornell University collection.

Neosciara columbia n. sp.

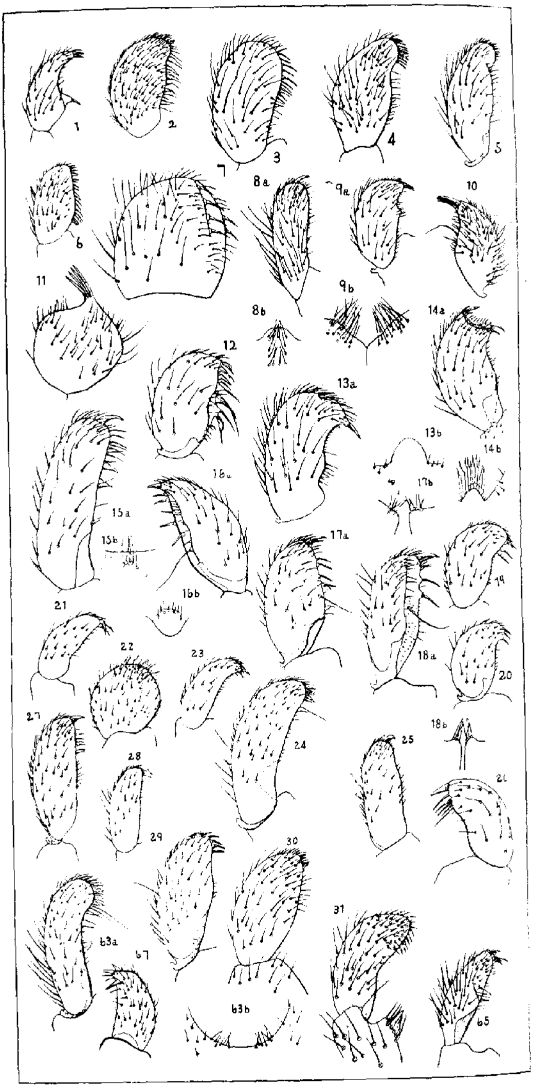
Male: Length, 1.2 mm. Head black, dull; antennæ fuscous, over half the length of the body, segments of flagellum twice as long as wide; palpi fuscous. Thorax dull, fuscous. Abdomen fuscous to black. Hypopygium fuscous, with 2 clusters of setæ no larger than the surrounding setæ, one cluster on each side of the mid-ventral line at the base (Fig. 63b); clasper (Fig. 63a) over twice as long as wide, with no stout spines, and with about 2 subapical long setæ on the inner margin. Legs fuscous; tibiæ and tarsi darker than coxæ and femora. Wings (Fig. 66) smoky brown; cubitus and media with no setæ; base of R_s distad of mid-point between the humeral cross vein and the tip of R_1; R_1 ends proximad of the forking of M; petiole of cubitus as long as the basal section of M; costa extends at least two-thirds the distance between R_s and M_1; R_s ends proximad of .85 the length of the wing and far proximad of the tip of M_2. Halteres; knobs fuscous, pedicels fulvous.

Described from 4 males collected at La Sierra, Columbia, South America, March 1, 1912. Type No. 238. Three paratypes. Cornell University collection.

EXPLANATION OF PLATES XXX AND XXXI.

Figures 1 to 31, inclusive, and Figures 63, 65 and 67 are from camera lucida drawings, much enlarged, each figure representing a clasper of the genitalia of a male. Figures 32 to 62 inclusive and Figures 64 and 66 are photomicrographs of the right wing of each species of male.

Fig. 1. *Sciara forceps* n. sp.
Fig. 2. *Sciara multisetifera* n. sp.
Fig. 3. *Sciara cylindrica* n. sp.
Fig. 4. *Sciara congregata* Joh.
Fig. 5. *Sciara psittacus* n. sp.
Fig. 6. *Sciara habilis* var.
Fig. 7. *Sciara globosa* n. sp.
Fig. 8. *Neosciara falcata* n. sp.
Fig. 9. *Neosciara fochi* n. sp.
Fig. 10. *Neosciara joffrei* n. sp.
Fig. 11. *Neosciara quadrispinosa* n. sp.
Fig. 12. *Neosciara luteola* n. sp.
Fig. 13. a, b, *Neosciara lobosa* n. sp.
Fig. 14. a, b, *Neosciara petaini* n. sp.
Fig. 15. a, b, *Neosciara grandis* n. sp.
Fig. 16. a, b, *Neosciara trifolii* n. sp.
Fig. 17. a, b, *Neosciara polychaeta* n.sp.
Fig. 18. a, b, *Neosciara conglomerata* n. sp.
Fig. 19. *Neosciara ovata* n. sp.
Fig. 20. *Neosciara trifurca* n. sp.
Fig. 21. *Neosciara pilata* n. sp.
Fig. 22. *Neosciara ericia* n. sp.
Fig. 23. *Neosciara penna* n. sp.
Fig. 24. *Neosciara pollicis* n. sp.
Fig. 25. *Neosciara hamata* n. sp.
Fig. 26. *Neosciara felti* n. sp.
Fig. 27. *Neosciara macroptera* n. sp.
Fig. 28. *Neosciara subtrivialis* n. sp.
Fig. 29. *Neosciara sexdentata* n. sp.
Fig. 30. *Neosciara perfecta* n. sp.
Fig. 31. *Neosciara caldaria* var.
Fig. 32. *Sciara forceps* n. sp.
Fig. 33. *Sciara multisetifera* n. sp.
Fig. 34. *Sciara cylindrica* n. sp.
Fig. 35. *Sciara congregata* n. sp.
Fig. 36. *Sciara psittacus* n. sp.
Fig. 37. *Sciara habilis* var.
Fig. 38. *Sciara globosa* n. sp.
Fig. 39. *Neosciara falcata* n. sp.
Fig. 40. *Neosciara fochi* n. sp.
Fig. 41. *Neosciara joffrei* n. sp.
Fig. 42. *Neosciara quadrispinosa* n. sp.
Fig. 43. *Neosciara luteola* n. sp.
Fig. 44. *Neosciara lobosa* n. sp.
Fig. 45. *Nesociara petaini* n. sp.
Fig. 46. *Neosciara grandis* n. sp.
Fig. 47. *Neosciara trifolii* n. sp.
Fig. 48. *Neosciara polychaeta* n. sp.
Fig. 49. *Neosciara conglomerata* n. sp.
Fig. 50. *Neosciara ovata* n. sp.
Fig. 51. *Neosciara trifurca* n. sp.
Fig. 52. *Neosciara pilata* n. sp.
Fig. 53. *Neosciara ericia* n. sp.
Fig. 54. *Neosciara penna* n. sp.
Fig. 55. *Neosciara pollicis* n. sp.
Fig. 56. *Neosciara hamata* n. sp.
Fig. 57. *Neosciara felti* n. sp.
Fig. 58. *Neosciara macroptera* n. sp.
Fig. 59. *Neosciara subtrivialis* n. sp.
Fig. 60. *Neosciara sexdentata* n. sp.
Fig. 61. *Neosciara perfecta* n. sp.
Fig. 62. *Neosciara caldaria* var.
Fig. 63. a, b, and Fig. 66. *Neosciara columbia* n. sp.
Fig. 64, 65. *Sciara paradoxa* n. sp.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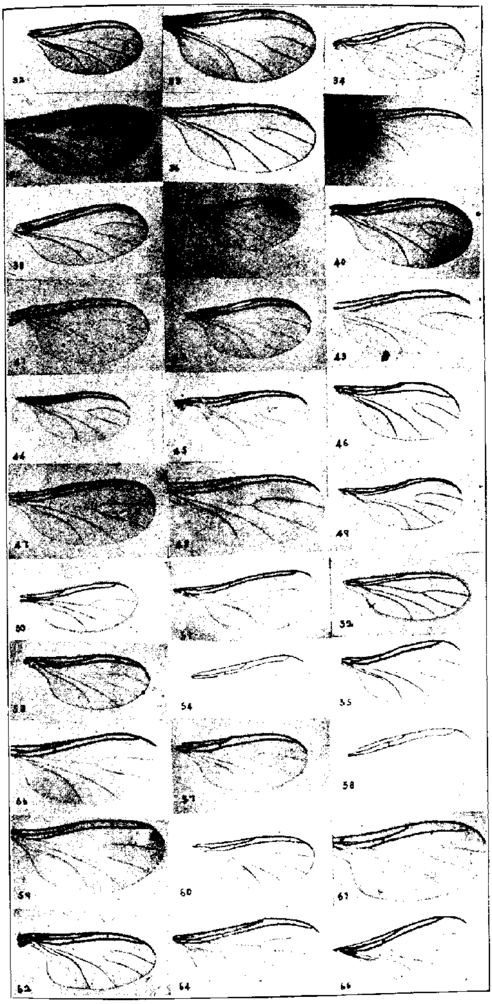
F. W. Pettey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F. W. Pettey

THE THORACIC SCLERITES OF THE GRASSHOPPER DISSOSTEIRA CAROLINA*

By G. C. Crampton, Ph. D.

There is perhaps no insect which is studied more frequently than the grasshopper, since the drawing of its structural details has served as an introduction to entomology for "generations" of students; yet the parts of its thorax have been surprisingly misinterpreted in practically all text-books and other publications in which it has been described.

Since the incorrect figures and descriptions of the grasshopper's anatomy have been so widely copied in various text-books, (the figures by Packard, 1898, having received the widest acceptance) and other publications, it has seemed advisable to make a further study of the structural details of this insect, with a view to determining what interpretation of the parts is the correct one. For this purpose, the thoracic structures of *Dissosteira carolina*, L., have been selected to illustrate the points to be considered in the following discussion, since this insect is as little modified as any of our common grasshoppers, and is among the largest (and hence the most easily examined) of the forms whose wide distribution makes them available to everyone for study.

In order to avoid the distortion due to the shrinking of dried material, only such specimens as have been preserved in alcohol, or similar preserving fluids, have been used, and in examining them, it has proved more satisfactory to keep the specimens immersed in a liquid medium (alcohol or water) and to illuminate the field of the binocular (which is the most satisfactory microscope for dissection work) by means of a nitrogen-bulb lamp provided with a condenser.

PROTHORAX.

The prothorax is the only thoracic segment which has remained freely mobile, the meso- and metathorax being rather closely united, although the line of demarcation between them is clearly evident. The grasshopper group thus differs from the crickets and katydids, in which the union of the mesothorax and metathorax is much less close, especially in the sternal region.

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* This paper is one of a series of contributions from the Entomological Laboratory of the Massachusetts Agricultural College, dealing with the anatomy of the grasshopper *Dissosteira carolina* L.

The Neck Region.

In front of the prothorax, of which it is a part, is a membranous neck region (Plate XXXII, Fig. 1, "vc"), called the *eucervix* or *veracervix*, by means of which the head is attached to the prothorax; and the membranous character of its integument permits a greater freedom of movement to the head. Since this membranous region might offer a more vulnerable point of attack than the more heavily chitinized segments, it is protected by the forward-projecting, anterior margin of the pronotum, into which the head fits, as in a collar.

Embedded in the more membranous walls of the neck region are several small plates called *jugular sclerites*, *cervical sclerites*, or *cervicalia*, which serve to strengthen the walls of the neck and to furnish points of articulation for the head. Some of them were also formed as points of attachment for certain muscles, since they offer a firmer support for muscle attachment than the more yielding membranous walls of the neck region. These sclerites are homologous with the intersegmental sclerites occurring between the different thoracic segments in certain lower insects, and therefore are not to be interpreted as representing the labial segment, or the remains of a rudimentary segment between the head and prothorax (see Crampton, 1917). In the grasshoppers only the *lateral* and *ventral cervical* sclerites are preserved. The anteriormost lateral cervical sclerite (Figs. 2 and 1, "lc") supports the head. The ventral one, Fig. 2, "ps" is homologous with the so-called *presternum* of lower insects.

The Pronotum.

The ***pronotum*** is a large saddle-shaped or "sunbonnet-shaped" structure which extends over the greater portion of the dorsal and lateral regions of the prothorax, and projects backward over the anterior portion of the segment behind it. The projecting posterior region of the pronotum is called the "*hind process of the pronotum*" by systematists (Text figure 2, "x"). The two postero-lateral margins of the pronotum form an angle (in which the letters "x" are contained in Text figure 2). Whether the angle containing the two letters "x" (Text figure 2) is a right angle, or an acute angle, is a feature used in classification. If the sides of the posterior region of the pronotum instead of making an angle, extend approximately straight across, the pronotum is spoken of as *truncate posteriorly*. Similarly, if the anterior margin is approximately straight, it is spoken of as *truncate anteriorly*. Whether the surface of the pronotum is *smooth, granulated* (powdery appearing), *wrinkled, rugose* or roughened with numerous tubercles, are other features of value in classification.

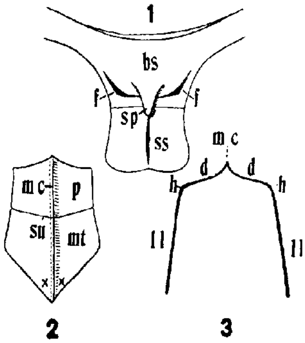

Fig. 1. Ventral view of prosternum of *Rhomalea*.
Fig. 2. Dorsal view of upper portion of pronotum of *Dissosteira*.
Fig. 3. Vertical transverse section through wall of pronotum of *Dissosteira*.

In the grasshopper *Dissosteira*, the pronotum is divided by a *notch* "n" (Fig. 1) and an impressed line "su" extending downward from it, into a *front* and *hind lobe*. The dorsal ridge "mc" (Fig. 1 and Text Figs. 1 and 2) extending longitudinally along the median line of the pronotum is called the *median carina*, and in *Dissosteira* it is broken by a single notch "n" (Fig. 1), while in other grasshoppers there may be two such notches. The median carina "mc" of Fig. 1 is high and arched on the hind lobe of the pronotum of *Dissosteira*, but in other grasshoppers it may be nearly obsolete on the hind lobe. This, and other features, such as whether the median carina is irregular (as in Dissosteria) or whether it is even in contour, are features used in classification.

A downward-bending of the pronotum along the shoulder-like ridge labeled "h" in Fig. 1 and Text Fig. 3 divides the pronotum into an upper surface or *disc* (*i. e.*, the region bearing the labels "p" and "mt" in Fig. 1, or that designated as "d" in Text Fig. 3) and two *lateral lobes*, one on either side of the body, labeled "ll" in Fig. 1 and Text Fig. 3. The shoulder-like ridge "h" of Fig. 1 and Text Fig. 3, demarking the disk of the pronotum from the lateral lobe "ll," is called the *lateral carina*, or better, the *humeral carina*, (since the term lateral carina is also applied to certain ridges of the head region). A lack of ability in shading, has made it difficult to show that the regions labeled "p" and "mt" in Fig. 1, represent a dorsal disc, while the sides, labeled, "ll" are bent downward at an angle with it, and thereby produce the shoulder-like ridge "h." Text Fig. 3, however, represents a vertical cross-section of the pronotum, in which each half of the disc labeled "d," corresponds to the regions designated as "p" and "mt" in Fig. 1. The other labelings are the same in both Text Fig. 3 and Fig. 1, so that by comparing the vertical cross section of the pronotum shown in Text Fig. 3, with the view of the pronotum shown in Fig. 1, the same parts may be readily identified in each.

As was mentioned above, the two lateral or humeral carinæ (Text Fig. 3, "h," and Fig. 1, "h") divide the pronotum into an upper disc and two lateral lobes. The notch "n" and the impressed line "su" extending downward from it (Fig. 1) divide the disc of the pronotum into an anterior region called the "*prozona*" and a posterior one called the "*metazona*" (Fig. 1, "p" and "mt"). It would be preferable to refer to these as the *prezona* and *postzona*, however, since the prefix "meta" is reserved for structures belonging to the meta-thorax alone. The fore and hind margins of the disc of the pronotum may be *truncate*, *rounded*, *angled*, *notched*, etc., and its surface may be smooth, wrinkled, etc., these features being used in classification.

Three approximately vertical sutures or impressed lines called *sulci* (Fig. 1, "su") divide the pronotum into *intralobes* or areas which, beginning with the anteriormost, have been incorrectly designated as the "prescutum," "scutum," "scutellum" and "postscutellum," although they are purely secondary structures having no connection with the four typical subdivisions of the notal region of the wing-bearing segments; and in some grasshoppers there are more than four of these "intralobes."

The Propleuron.

Contrary to the statement that the pronotum has "crowded out" the pleural region of the prothorax (Snodgrass, 1909, pp. 534, 555 and 556), the lateral portions of the pronotum "ll" of Fig. 1 have merely grown down *over* the pleural region which lies beneath the overlapping pronotum, the surfaces of the two regions being closely applied to each other. If one of the larger grasshoppers such as *Rhomalea* be boiled in caustic potash to soften the sclerites, it will be found very easy to separate the pleural sclerites from the overlapping pronotum by inserting a knife blade between the two, and gently forcing them apart. It will then be seen that the *episternum* and *epimerum* (Fig. 2, "es_1" and "em_1") are the principal sclerites of the pleural region, as in the other segments, and that both extend far upward under the overlying pronotum. The lower portion of the episternum and epimerum project below the lower margin of the pronotum in *Dissosteira* (Fig. 2, "es_1" and "em_1"), and if a specimen be boiled in caustic potash, the pleuron can be separated from the overlying pronotum, in this insect also, but this is much more easily accomplished in the larger forms such as *Rhomalea*. The middle one of the three sulci labeled "su" in Fig. 1, is superimposed upon the pleural suture (separating the episternal from the epimeral region) of the prothoracic pleural region which is overlapped by the sides of the pronotum, and, since the surfaces of the pleural region and the pronotum are so closely applied together, it is possible that the presence of the pleural suture is responsible for the formation of the middle sulcus "su" which is directly over it and coincides with it exactly. The posterior suclus "su" is closely associated with the margin of the inflexed portion of the posterior region of the pronotum which is folded in under the remainder of the pronotum, and the surface of the fold is closely applied to the surface of the pronotum. It is possible that the attachment of this margin on the inner surface of the pronotum has given rise to the posterior sulcus "su," and it is thus clearly evident that the sulci "su" of Fig. 1 owe their origin to mechanical causes, rather than to the assumed fact of their representing the four tergal subdivisions of the notum of a wing-bearing segment. Since the pleural region is present, although closely applied to the inner surface of the pronotum which overlaps it, it thus is incorrect to state that the pronotum has crowded out the propleural region and has assumed its functions.

At the base of the leg is a small articulatory plate "tn" of Figs. 1 and 2. This represents a portion of the *trochantin*, which is much reduced in the Orthoptera.

The Leg.

Only the basal segments of the leg are shown in the accompanying figures, the femur being shortened in each case. As shown in Fig. 2, the prothoracic *coxa*, "cx_1," is divided into several subdivisions, but these have no especial significance. One of these subdivisions bears a *coxal spine* "cs." The coxa is broader than long. The *trochanter* "tr", is small and is quite closely united with the femur.

The Prosternum.

The pleural region of the thorax is connected with the prosternal region by a *pre-coxal bridge* extending in front of the sclerite "tn" (Fig. 2). This pre-coxal bridge is largely made up of a lateral wing of the sternal region, although a small portion of the pleural region is also involved in its make-up.

The anteriormost sclerite of the prosternal region is the small plate "ps" (Fig. 2), which is homologous with the so-called ***presternum*** of lower insects. Immediately back of the presternum "ps" is a narrow anterior marginal region "pr_1," homologous with a similar anterior marginal region "pr_2" in the mesosternal region. The term ***prepectus*** has been very appropriately applied to this region in the Hymenoptera by Snodgrass, 1910, although Snodgrass does not think that the sclerite of the Hymenoptera is homolgous with this sclerite in the Orthoptera. Just behind the region "pr" is the ***basisternum*** "bs_1," whose lateral wings form the precoxal bridges connecting it with the pleural region on either side. In some grasshoppers, this region (the basisternum) bears a prominent spine, the ***prosternal spine*** (Text Fig. 1, "sp") projecting backward between the front coxæ. The presence or absence of this spine is a feature used in classification. Behind the region "bs_1" (Fig. 2) is an area largely composed of the ***spinasternum***, or fourth chief sternal subdivision which has united with the third to form a region sometimes called the ***sternellum***. In this region are situated the two *furcal pits* "f," and the median *spinal pit* "ss_1." The furcal pits "f" are the outward indications of a pair of invaginations or hollow "in-pushings" of the integument serving as structures for muscle attachment. These paired invaginations are called *apophyses*, and when their basal portions unite, while their distal portions remain free to form the two arms of a "Y," the structure is called the *furca* or forked internal structure for muscle attachment. The spinal pit "ss" is the outward manifestation of an internal unpaired median process called the *spina*, which also serves as a point for muscle attachment.

MESOTHORAX.

Despite the fact that the fore wings are reduced to form the so-called *tegmina* which are not as important as the hind wings for flight, and despite the greater development of the hind legs for leaping, and the consequent greater development of the muscles of the metathorax, the mesothorax is subequal to the metathorax in size, being but slightly smaller than the latter.

The Mesonotum.

In the anterior region of the mesonotum is a narrow marginal region "pt_2" (Fig. 3) known as the *pretergite*. In some insects it bears an internal transverse fold called the *phragma*, to which are attached certain dorsal longitudinal muscles serving to arch the notal region in the movements of flight. Immediately behind the region "pt" is an area "psc_2" corresponding to the *prescutum* of other insects, but the prescutum is not demarked from the remainder of the tergal plate in the grasshopper under consideration. The greater portion of the tergal plate is composed of the *scutum* "sc_2," although its limits are not clearly defined in the notum of *Dissosteira*. The region labeled "sl_2" is the *scutellum*, and the area on either side of it is known as the *parascutellum* or *juxtascutellum*, "js_2." The posterior marginal area "po" is the *postergite*, which is a fold-like region projecting backward over the front portion of the segment behind it for a considerable distance in lower insects such as the Mantids, Termites, etc. With the region labeled "js_2" the fold "po" is sometimes incorrectly referred to as the "postscutellum," but the true mesothoracic *postscutellum* is greatly reduced, and projects vertically downward below the fold which overlaps it, and the postscutellum also bears a *phragma* or internal transverse process for the attachment of the longitudinal muscles arching the notum in the movements of flight.

Along the sides of the *notum*, or tergal region of the segment, are several projections, some of which are involved in the movements of flight. The anterior projection "pa$_2$" or *prealare*, sometimes forms a complete pre-alar bridge extending in front of the wing from the tergal region to the pleural region, and in some insects it extends down to, or slightly beyond, the pleural plate "ba" of Fig. 3, (*i. e.*, the anterior one of the two plates labeled "ba$_2$" in Fig. 1). The projecting region "sur$_2$" (Fig. 3) or *suralare* is frequently demarked by a complete suture, and it serves as an anterior pivot for the wing, in the movements of flight. Certain of the other projections also serve as pivots for the wing in the movements of flight, but are of no great morphological importance.

The Wing-Ossicles.

At the bases of the wing veins are several small articulatory plates called *alar ossicles*, which assist in the articulation of the wings to the tergal region. There are also some small plates below the wing near its attachment to the body, and these are also included under the designation *alar* or *wing ossicles*. The alar ossicles by means of which the wing articulates with the tergal region or notum, are called *pteralia*.

A small plate called the *tegula* "tg" (Fig. 3) occurs near the anterior margin of the wing, at its base, and might be included with the alar ossicles. The principal alar ossicle, however, is the *notopterale* "np$_2$," which seems to be a detached portion of the tergal region which doubtless originally projected from its lateral margin somewhat after the fashion of the sclerite "sur." In its typical form, this ossicle bears an anterior neck-like narrow region articulating with the base of the vein called the subcosta in Comstock's terminology. Beside the ossicle "np" is a more or less distinct ossicle "m," which is formed at the bases of certain of the wing veins. The radius, media and cubitus of Comstock's terminology may extend to it, although a chitinized area may intervene between it and the bases of certain of these veins. The sclerite "m" has been termed the *medipterale*, or the middle one of the pteralia. The ossicle "b" or *basanale* is situated at the base of the anal veins, and articulates with a posterior process of the notum which may become detached to form an intermediate plate "a" called the *adanal ossicle*.

The Mesopleuron.

Beneath the wing, at its base, are several alar ossicles which are apparently of a pleural origin, or were formed in the region largely belonging to the pleuron. These have been called the *alaria*, in contradistinction to the pteralia which are tergal ossicles. The two anteriormost of these ossicles "ba_2," called the *basalar ossicles*, are situated at the base of the wing, immediately in front of the dorsal neck-like prolongation of the pleural region serving as a ventral pivot for the wing in the movements of flight. Immediately above this pivot, is the *intralare* "ia_2," and just behind it is the *subalar* ossicle "sa_2."

The greater part of the mesopleural region is composed of the *epimerum* "em_2" and the *episternum* "es_2," which are separated by the *pleural suture* extending in an approximately vertical line from the wing base to the coxal region. Extending along the anterior margin of the region "es_2" is a narrow sclerite "pr_2" called the *prepectus*, and in the upper portion of the episternal region "es_2" a small area labeled "ae" is marked off by a faint suture. Ventral to the episternum and epimerum a *pericoxal* sclerite "pc" extends around the base of the coxa, and encloses the small sclerite "tn," which is all that remains of the much reduced *trochantin*.

In the membranous "intersegmental region" between the prothorax and mesothorax is the first thoracic spiracle "s." This spiracle has been attributed to the prothorax, but from the standpoint of embryology, it is mesothoracic, since it has its embryonic origin in the anterior region of the mesothorax and later migrates into the "intersegmental" region (which is also largely mesothoracic).

The Leg.

As in most Orthoptera, the bases of the legs are widely separated. The pericoxal sclerite "pc_2" encircling the base of the coxa (Figs. 1 and 2) seems to be peculiar to the grasshopper group, since I have been unable to find it in any of the crickets, mole-crickets, or katydids which I have examined. The pleural suture between the epimerum "em$_2$" and episternum "es$_2$" (Fig. 1) is continued downward into the coxal region "cx$_2$" as the *coxal suture* which divides the coxa into an anterior region (*veracoxa*) and a posterior region (*meron*) in higher insects. The mesothoracic coxæ are broader than long, and tend to assume a ring-like outline.

The Mesosternum.

The mesosternum is connected with the pleural region by a *pre-coxal bridge* "ls$_2$" (Figs. 1 and 2) extending in front of the coxa on either side of the sternum. In the crickets and katydids, this region ("ls") forms a distinct plate, the *laterosternite*, but in the grasshoppers, it is fused with the episternal region, although a faint line marks it off from the sternal region ventrally. This region originates as a lateral wing of the sternal region, although its true nature is sometimes masked by its secondary union with the pleural region.

A ventral extension of the *prepectus* "pr$_2$" (Fig. 1) is continued around into the sternal region (Fig. 2, "pr$_2$") and up the surface of the other flank, thus making an anterior marginal sclerite bordering the pleural and sternal regions. The large sternal sclerite immediately behind it is the *basisternite* "bs$_2$," and posterior to this is the narrow transverse region containing the *furcal* and *spinal pits* ("f$_2$" and "ss$_2$") which mark the location of the internal *furca* and *spina*, or processes for muscle attachment. This region corresponds to the united third and fourth principal sternal subdivisions (the *furca-* and *spinasternite*) to which the designation "*sternellum*" is sometimes applied in the prothoracic region.

In the posterior region of the mesosternum, a suture extending backward in a broad sweep from each of the furcal pits "f$_2$" marks off a lobe "l$_2$" and "l$_2$" on either side of the sternal region. These two lobes are referred to as the *mesosternal lobes* by systematists, while the similar lobes "l$_3$" and "l$_3$" marked off in the metasternal region are termed the *metasternal lobes*, and the relative width between these mesosternal lobes (measured transversely between the points labeled "x" and "x" in the mesothorax) as compared with the distance between the metasternal lobes (measured transversely between the points labeled "x" and "x" in the metathorax) is a feature used in classification. Thus in the grasshopper shown in Fig. 2, the mesosternal lobes are only "slightly more distant than the metasternal lobes"; in other words, the distance from "x" to "x" in the mesosternum is subequal to that from "x" to "x" in the metasternum. In the males, however, the mesosternal lobes may be nearly twice as distant as the metasternal lobes, so that this feature holds good only for females.

METATHORAX.

In the crickets, mole-crickets and most katydids, the metathorax is markedly larger than the mesothorax, especially in the tergal region (as is also true of a few other insects, such as the earwigs, beetles, Strepsiptera, etc.) and one would naturally expect the same to be true of the grasshopper group also, since the hind wings and hind legs are much larger than the others and consequently require larger muscles for operating them. The meso- and metathorax are subequal in size, however, in *Dissosteira*, and the two wing-bearing segments are more or less closely united to furnish a firmer support for the wing muscles, since the grasshoppers are better fliers than the crickets and katydids.

The Metanotum.

An anterior region "psc_3" which corresponds to the *prescutum* is indistinctly marked off in the tergal region of the metathorax (Fig. 3), and behind it is the scutum "sc_3" which is of a somewhat indefinite extent. The *parascutellar* regions "js_3" of the metanotum are not strictly homologous with the regions labeled "js_2" in the mesonotum, since they extend over a greater area in the metanotum; but it is inadvisable to attempt to distinguish between the two in the different segments, since they are practically the same in position, etc., in both meso- and metathorax. The metathoracic *scutellum* "sl_3" is not very different from the mesothoracic scutellum "sl_2"; but the *postergite* "po_3" or region behind the scutellum is of greater extent in the metathorax than in the mesothorax ("po"). The mesothoracic postscutellum is greatly reduced, and is overlapped by the region "po," but in the metathorax, the *postscutellum* "psl_3" is large and well developed, although it is more or less closely united with the first abdominal tergum. Along its posterior margin, it bears an internal transverse ridge or *phragma*, to which certain longitudinal dorsal muscles are attached (and which serve to arch the tergal region in the movements of flight). The *prealar region* "pa$_3$" of the metanotum is essentially like that of the mesonotum "pa$_2$," but the *suralar* process "sur$_3$" of the metathorax is slightly different from that of the mesothorax "sur$_2$."

The Wing-Ossicles.

The *tegula* "tg$_3$" (Fig. 3) is present in the metathorax as well as in the mesothorax of the grasshopper, unlike many other forms in which it is retained in the mesothorax alone. The *median ossicle* "m$_3$" of the metanotum is not very different from its homolog in the mesonotum; but the *notopterale* "np$_3$" has lost its slender neck-like prolongation present in the homologous plate "np$_2$" of the mesonotum; although the small plate just in front of the projection "sur$_3$" of the metanotum, doubtless represents the remains of this anterior neck-like prolongation of the notopterale. The *basanal* region "b$_3$" at the base of the anal veins is much larger in the metathorax than in the mesothorax, but the plate "a" of the metanotum is smaller than its homolog in the mesonotum.

The Metapleuron.

The ossicles "ba$_3$," "ia$_3$" and "sa" (Fig. 1) of the metathoracic region are essentially like those of the mesothorax. The postscutellum "psl$_3$" extends downward behind the wing, making a postalar bridge connecting the tergal region with the *epimerum* "em$_3$," whose shape is somewhat different from that of the mesothoracic epimerum "em$_2$." The metathoracic *episternum* "es$_3$" is demarked from the region "ls$_3$" by a faint line which is absent in the mesothorax, while on the other hand, the faint line demarking the region "ae" which is present in the mesothoracic episternum is lacking in the metathoracic episternal region. The region "ls$_3$" is largely composed of the *laterosternite*, or lateral wing of the sternal region. Behind it, a narrow *antecoxal region* "ac$_3$" is marked off in front of the metathoracic coxa "cx$_3$," and appears to be homologous with a portion of the pericoxal ring "pc$_2$" extending around the mesothoracic coxa. The metathoracic trochantin is reduced to the small plate "n" at the base of the coxa. The metathoracic spiracle "s" is actually situated in the intersegmental region, but appears to be located in the posterior portion of the mesothoracic pleuron.

The Leg.[*]

The metathoracic coxa "cx_3" is much larger than the coxæ of the other segments due to the greater development of the hind legs for leaping, and tends to become longer than the other coxæ. The trochanter "tr_3" (Fig. 2) is greatly reduced, and is more readily seen from the ventral (or mesal) surface. The femur is greatly thickened for leaping, and is provided with prominent longitudinal ridges on its inner surface.

The Metasternum.

The principal region of the metasternum is the *basisternum* "bs_3" (Fig. 2) which interlocks with the mesosternum in front of it, the narrow anterior region of the metasternum being "dovetailed" between the mesosternal lobes "l_2" and "l_2." The lateral wings of the basisternum largely make up the sclerite "ls_3" forming a pre-coxal bridge on either side of the body, connecting the sternal with the pleural regions. The *antecoxal region* "ac_3" is largely sternal in origin, and, with the sternal sclerite "st," it forms an incomplete ring extending around the base of the coxa anteriorly, so that these two sclerites may represent a portion of the ring "pc" which completely encircles the base of the mesothoracic coxa. The *furcal pits* "f_3" are retained in the metasternum, but the spinal pit "ss_2" of the mesosternal region has disappeared in the metasternum. The *metasternal lobes* "l_3" and "l_3" are somewhat smaller than the mesosternal lobes. In certain grasshoppers the transverse distance between the two points "x" and "x" of the metasternum is only half the distance between the points "x" and "x" of the mesothorax (*i. e.*, the mesosternal lobes are "twice as distant" as the metasternal lobes)—a feature frequently used in classification. The greater part of the region between the metasternal lobes "l_3" and "l_3" is thought to be an anterior "neck" of the first abdominal sternum which has become wedged in between the metasternal lobes, although it is rather difficult to understand how such a dovetailing process could be brought about. At any rate, the mesosternum *appears* to be dovetailed into the metasternum and the first abdominal sternum appears to be dovetailed into the metasternum, which is a condition peculiar to the grasshopper group (so far as I am aware). None of the crickets or katydids which I have examined has a mesothoracic ring "pc$_2$" about the base of the coxa (Figs. 1 and 2), or a metathoracic sclerite like those shown in Fig. 2, "ac$_3$" and "st," so that these structures, together with the "dovetailed" condition of the sternal regions, may be characteristic of the grasshoppers alone, and serves to further separate them from the crickets and katydids.

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[*] Since the coxa of the metathorax is called the metacoxa, the tibia of this segment is called the metatibia, etc., the tarsus of the metathorax should be designated as the metatarsus; but since the designation metatarsus is sometimes incorrectly applied to the basal tarsal segment of the prothoracic or mesothoracic legs, it is preferable to designate the basal segment of the tarsus as the protarsus or basitarsus, in all cases, if we are to avoid ambiguity.

OTHER INTERPRETATIONS.

The Tergal Region.

Brooks, 1882, page 247 (also Fig. 130 of "*Acridium*") is apparently responsible for the frequently repeated statement that the pronotum of the grasshopper is divided into four regions homologous with the prescutum, scutum, scutellum, and postscutellum of the other segments of the thorax, and this view has been adopted by Comstock and Kellogg, 1902 (p. 21) and many other writers. The fact that this view cannot be the correct one, however, is demonstrated by the occurrence of five or even six such areas in the pronota of some grasshoppers, as well as by the fact that the four principal tergal subdivisions never occur as transverse bands in the other segments. The line of division between the true scutum and scutellum never lies directly over the pleural suture (as is supposed to be the case in the pronotum), since the true scutellum is usually triangular in outline. Furthermore, the true postscutellum is always formed as a plate distinct from the plate in which the prescutum, scutum, and scutellum are demarked, and, in connection with many other facts such as the nature of the musculature attached to the regions in question, etc., the pronotal subdivisions cannot possibly be interpreted as representing the four typical tergal subdivisions, but evidently owe their origin to mechanical causes as pointed out in the preceding discussion.

Brooks, 1882, (p. 250, and Fig. 133) would interpret the narrow transverse marginal region of the mesonotum ("pt$_2$" of Fig. 3 of this paper) as the "prescutum," but it is clearly not the entire prescutum, being merely the narrow anterior marginal region of the prescutum called the pretergite. Brooks (p. 250) apparently interprets the alar ossicle "np_2" as the "patagium" (which is really an erectile lobe on the pronotum of Lepidoptera, having nothing to do with the sclerite "np_2," although Brooks may have had the tegulæ in mind, since the tegulæ are sometimes incorrectly homologized with the sclerite "np_2") and he homologizes the regions "js_2" and "po" (of Fig. 3 of the present paper) with the "postscutellum." (See also Fig. 32 of Melanoplus by Lugger, 1898). The true postscutellum of the mesothorax, however, is situated below the region "po" and bears the characteristic longitudinal dorsal muscles attached to the postscutellum of other insects, so that the representative of a mesothoracic postscutellum is present in grasshoppers, despite Snodgrass' statement to the contrary.

Berlese, 1909. has discussed the tergal region of *Acridium*, but, since I have no specimens of the species which he figures, I am not sure that the regions into which he subdivides the tergum correspond to those here given, especially since Berlese doesn't homologize the sclerites correctly in different insects, and as Snodgrass, 1909 (p. 535) very truly remarks "in order to carry out his scheme, Berlese has in many cases drawn purely arbitrary lines across the notum." Furthermore, Berlese employs the prefixes "pro," "meso," and "meta" for subdivisions of one and the same segment instead of limiting the prefix "pro" to prothoracic structure, "meso" to mesothoracic structures, and "meta" to metathoracic structures. Thus "metatergite" to any one else would mean the tergite of the metathorax, but Berlese applies this term to a subdivision of the pronotum, mesonotum or metanotum indiscriminately, as is also true of his terms "mesotergite" and "protergite." As nearly as I can determine, the tergal subdivisions which he describes in *Acridium* correspond to the following tergal sclerites of the grasshopper here discussed.

In his Fig. 1, Plate IV, Berlese applies the term "acrotergite" to the *anteriormost* tergite "pt_2" of the mesothorax of the grasshopper (Fig. 3 of this paper) while he applies this same term to the *posteriormost* tergite "psl_3" (Fig. 3) in the metathorax of the grasshopper. In the mesonotum, he terms only the region "sur_2" the "protergite," and homologizes it with the entire prescutum "psc_3" in the metathorax. The scutum "sc" and scutellum "sl" comprise his "mesotergite" and the region which he calls the "metatergite" is apparently the sclerite "[illegible]" and "po" together. In his Fig. 274 of the metanotum of *Acridium*, Berlese terms the tegula "tg_3" the "acroptero," and designates the ossicles "np_3" and "m_3" together as the "proptero." The sclerite "a" he terms the "mesoptero," and designates the region "b_3" as one of the "capi delle nervature delle interala."

The Pleural Region.

The lateral cervical sclerites "lc" (Figs. 1 and 2) are interpreted as the episternum and epimerum of the labial segment of the head by Comstock and Kochi 1902 in their Fig. 20 of the lateral neck plates of *Melanoplus* (see also Fig. 26 of Melanoplus by Hosford, 1913); but, in a paper dealing with the nature of the neck sclerites (Crampton, 1917) it was shown that these plates are merely detached portions of the prothorax, and therefore cannot represent the episternum and epimeron of the labial or any other segment.

In his Fig. 7 of the mesopleuron of *Acridium*, Jordan, 1902, calls the region "ae" of Fig. 1 (of this paper) the "parasternum" (a term previously applied to a different region by Heymons and others); but in other instances, Jordan applies the term "parasternum" to the basalar plates "ba." He terms the sclerite "pr_2" (Fig. 1) the "peristernum" in the pleural region, and designates its median ventral portion "pr_2" of Fig. 2, as the "mesoclidium," although it is not homologous with the sclerites which he designates as the "mesoclidium" in his other figures (*e. g.*, his Figs. 17, 19, etc., in which the "mesoclidium" appears to represent the region "ss" of Fig. 2 of this paper). Comstock and Kellogg, 1902, call the region "pr_2" the "sternellum."

Berlese, 1909, designates the basalar plates "ba" (Fig. 1) as the "due meta dell' acrosterno o prefulcro," while he terms the sclerites "ia" the "endoptero," and "sa" the "paraptero." Snodgrass, 1909, also appears to think that these plates at the base of the wing are the "paraptera," since he calls the anterior ones "ba" the "episternal paraptera" and the posterior one "sa" the "epimeral parapteron," but, as was pointed out in a paper dealing with the application of the terms parapteron, hypopteron, etc. (Crampton, 1914b) the designation parapteron is a synonym of tegula alone, and is so used in practically all textbooks of Entomology.

In his Fig. 89 of the locust *Melanoplus*, which has been copied in many textbooks and other publications, Packard, 1898, restricts the term coxa to the anterior region of the coxa ("cx_2" of Fig. 1 of this paper) and terms its posterior portion the "trochantine," in the pro- and mesothorax of the grasshopper, although the true trochantin "tn" (or what is left of it) is present. In the metathorax of his figure of *Melanoplus* Packard interprets the anterior region of the membranous area above the coxa "cx_3" (Fig. 1) as the "coxa" and the posterior region of this membranous area he designates as the "trochantine." The true metathoracic coxa "cx_3," he calls the trochanter.

The Sternal Region.

Jordan, 1902, in his Fig. 7 of *Acridium* terms the ventral portion of the anterior marginal region "pr_2" (Fig. 2 of this paper) the "mesoclidium" in the mesothorax of the grasshopper, and designates the lateral portion of this marginal region as the "peristernum." The term "sternum" is restricted to the portion of the sternum behind the region "pr_2" by Jordan, who applies the term "sternite" to the ventral and entire lateral region of the segment.

Snodgrass, 1909, in his Fig. 70, of the mesopleuron of *Dissosteira*, terms the region "pr_2" (Figs. 1 and 2 of this paper) the "pre-episternum," but the "pre-episternum" of his Fig. 56 of *Melanoplus*, and Fig. 57 of *Hippiscus* is an entirely different sclerite, namely the region "ls_3" of Fig. 1 (of this paper). Snodgrass, 1910, designates a region which for all practical purposes corresponds to the region "pr_2" (Figs. 1 and 2) as the "prepectus" in the Hymenoptera, but he claims that the "pre-episternum" is not present in the Hymenoptera. This is apparently due to the fact that he has applied the term "pre-episternum" to so many different sclerites in his earlier paper; but since the region which he calls the prepectus in the Hymenoptera is located in the same position as the sclerite which he designates as the "pre-episternum" in the grasshoppper *Dissosteira*, and extends into the sternal region in the same way (*i. e.*, sclerite "pr_2" of Fig. 1), it would appear that Snodgrass is mistaken in concluding that the "prepectus" of Hymenoptera is not to all intents and purposes homologous with the sclerite "pr_2" (Figs. 1 and 2) which he terms the "pre-episternum" in *Dissosteira*. The term "prepectus" is much preferable to "pre-episternum" however, since "pectus" is the term for the united pleural and sternal regions; and "pre-pectus" is therefore a very appropriate designation for the anterior marginal region of the pleural and sternal regions, so that the designation prepectus has been retained in the present paper rather than the designation "pre-episternum" or the designation "hypopteron" which was originally applied to this region in the Coleoptera by Audouin (see Crampton, 1914b).

Comstock and Kellogg, 1902, (p. 22) have proposed the surprising view that the sclerite "pr_2" of Figs. 1 and 2 (which represents the anterior marginal prepectus of the *mesothorax* is the "sternellum of the *prothorax*," and they would homologize it with the mesothoracic lobes "l_2" and "l_2" of Fig. 2, which they regard as the "widely separated halves of the sternellum of the mesothorax" (p. 24). These in turn, they homologize with the metathoracic sclerites "st" of Fig. 2, which they refer to on page 24 as "the two halves of the sternellum of the metathorax . . . widely separated, each being situated near the base of the leg." If one takes into consideration such "landmarks" as the furcal pits "f" however, it will be seen that it is impossible to homologize the regions "pr_2" or "l_2" with "st" in Fig. 2. Comstock and Kellogg restrict the term "sternum" to the region in front of the lobes.

In his Figs. 197 and 198 of the sternal region of *Acridium*, Berlese 1909 gives some very astonishing interpretation of the sclerites. Thus in the mesothorax, he restricts the term "sterno" (*i. e.*, sternum) to the marginal region "pr_2" (Fig. 2) alone, and designates all the remainder of the mesosternum (*i. e.*, "bs_2" and "l_2" of Fig. 2) as the "sternello" (*i. e.*, sternellum). In the metathorax, however, he calls practically the entire metasternum the "sterno" and designates the first abdominal sternum as the "sternello" of the metathorax. In fact, Berlese's interpretations of many of the sclerites in his figures of the thorax of different insects are so incorrect as to greatly detract from the value of his book as a basis for research, although its monumental size and wide scope have placed it among the most important of the reference works in Entomology

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EXPLANATION OF PLATE XXXII.

In all Figures the legs have been shortened, and the head has been removed. Only the first abdominal segment shown.

Fig. 1. Lateral view of the neck, thorax and first abdominal segment.
Fig. 2. Ventral view of same.
Fig. 3. Dorsal view of mesonotum, metanotum, and a portion of the first abdominal tergum.

ABBREVIATIONS.

The subscripts 1, 2 or 3, denote that the structure in question belongs to the pro-, meso-, or metathorax respectively. 1 ab denotes the first abdominal segment.

a, Adanale, or adanal ossicle.
ab, Abdominal segment.
ac, Antecoxale, or antecoxal piece.
ae, Anepisternum, or upper region of episternum.
b, Basanale, or basanal ossicle.
ba, Basalar sclerite.s
bs, Basisternum.
cs, Coxal spine.
cx, Coxa.
d, Disc of pronotum.
em, Epimerum.
es, Episternum.
f, Furcal pits.
h, Lateral or humeral carina of pronotum.
ia, Intralare, or intralar ossicle.
js, Parascutellum, or juxtascutellum.
l_2, Mesosternal lobes (lobisternite).
l_3, Metasternal lobes (lobisternite.
lc, Lateral cervicals.
ll, Lateral lobes of pronotum.
ls, Laterosternite, or wing of sternal region.
m, Medipterale, or median ossicle.
mc, Median carina of pronotum.
mt, Postzona, or "metazona" of pronotum.
n, Notch in median carina.
np, Notopterale, or notopteral ossicle.
p, Prezona, or "prozona" of pronotum.
pa, Prealare, or prealar region.
pc, Pericoxale, or pericoxal ring.
po, Postergite.
pr, Prepectus, or hypopteron.
ps, Presternum.
psl, Postscutellum.
pt, Pretergite.
s, Spiracle.
sa, Subalare, or subalar plate.
sc, Scutum.
sl, Scutellum.
sp, Prosternal spine.
ss, Spinal pit.
st, Sternocoxale, or sternocoxal sclerite.
su, Sulci, or pronotal sutures.
sur, Suralare, or suralar region.
tg, Tegula, or parapteron.
tn, Trochantin, or trochantinus.
tr, Trochanter.
vc, Neck region, eucervix, or veracervix.

Fig. 1

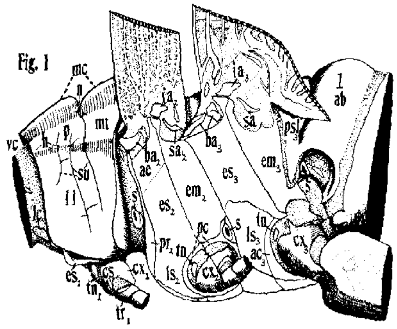


Fig. 2

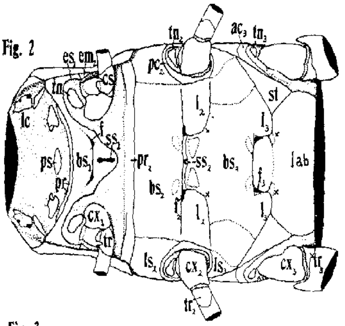
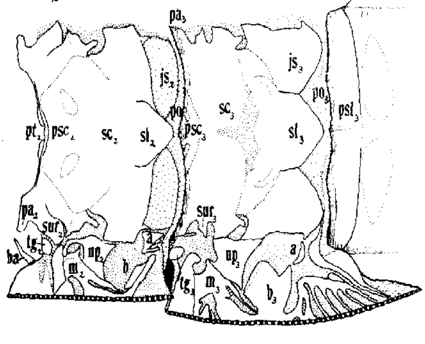


Fig. 3



G. C. Crampton

MYRIOPODS FROM OKEFENOKEE SWAMP, GA., AND FROM NATCHITOCHES PARISH, LOUISIANA.

By RALPH V. CHAMBERLIN.

The myriopods noted in the present paper compose a collection made in the Okefenokee Swamp by the Cornell University Expedition of 1912 and 1913 and one made by Mr. Karl P. Schmidt in Louisiana in 1915. The specimens of the second collection were all taken near the town of Creston in Natchitoches Parish. The species secured in the two localities are shown in the two separate lists below. Type specimens are placed in the Museum of Comparative Zoology, Cambridge, Massachusetts.

OKEFENOKEE SWAMP.

Scutigerella immaculata (Newport).
Cleidogona sp.
Leptodesmus okefenokensis sp. nov.
Polydesmus sp.
Spirobolus marginatus (Say).
Spirobolus paludis sp. nov.
Cryptops hyalinus Say.
Theatops posticus (Say).
Hemiscolopendra punctiventris (Newport).
Helembius nannus gen. et sp. nov.

LOUISIANA.

Callipus lactarius (Say).
Leptodesmus hispidipes (Wood).
Euryurus erythropygus (Brandt).
Euryurus louisianus sp. nov.
Fontaria lampra sp. nov.
Fontaria clara sp. nov.
Polydesmus serratus Say.
Nemasoma pium sp. nov.
Parajulus robustior sp. nov.
Cambala annulata (Say).
Spirobolus marginatus (Say).
Cryptops hyalinus Say.
Otocryptops sexspinosus (Say).
Theatops posticus (Say).
Scolopendra viridis Say.
Scolopendra heros Girard.
Hemiscolopendra punctiventris (Newport).
Linotaenia fulva (Sager).
Arenophilus bipuncticeps (Wood).
Arenophilus watsignus Chamberlin.
Geophilus mordax Meinert.
Nannocrix porethus gen. et sp. nov.
Neolithobius mordax (L. Koch).
Neolithobius transmarinus (L. Koch).
Neolithobius helius sp. nov.

SYMPHYLA.

Scutigerella immaculata (Newport).

One specimen taken on Billy's Id., Okefenokee Swamp, in June, 1912.

DIPLOPODA.

Cleidogona sp.

A number of specimens not yet adult. All are in the stage possessing twenty-three segments and are not at this time determinable as to species with certainty. They were taken on Billy's Id., Okefenokee Swamp, in June, 1912.

Leptodesmus hispidipes (Wood).

Numerous specimens taken near Creston, La., in February, March and May, 1915.

Leptodesmus okefenokensis sp. nov.

This is a smaller species than *hispidipes*, which it in general resembles. There is no trace of a median dorsal drak line, the dorsum being clear testaceous with no distinct markings excepting the carinæ which are lighter, yellow, though there is a rather vaguely lighter border caudally on some of the somites.

Somites in general smooth and shining, not at all tuberculate or roughened.

Vertigial sulcus of head deep, extending ventrad to a little above level of antennæ, with two setæ on each side. Antennæ long, the ultimate article and the distal end of the penult blackened.

Each end of first dorsal plate subacute, narrowly rounded. Posterior margin of second and third plates straight, the keels not at all produced caudad. Posterior corners of other plates produced caudad, more strongly so in posterior region. Pores opening laterally or slightly above the thickened border of keels which are slightly incurved at level of pores.

Anal tergite of usual form, distally truncate and a little decurved, with three long setæ on each side. Anal scale semicircular in outline. Anal valves mesally margined, the borders being strongly though narrowly elevated.

Ventral plates without processes in male. Plates smooth and most glabrous or nearly so.

In the gonopods of the male the proximal division is rounded. It bears two completely separated branches of which the smaller proximal one meets and crosses the one of opposite gonopod in the middle line. The principal branch of each gonopod is curved caudad and then dorsad, crossing the other one at its tip; distally it is bifurcate, the outer blade being much the more slender and bending first away and then again towards the proncipal process; the branch as a whole is densely setose on its mesal surface proximad of its middle, being elsewhere glabrous in striking contrast to the conditions in *hispidipes*, from which the bifurcate tip and other structural features also remove it.

Length, cir. 21 mm. Width, 3.7 mm.

Locality.—Okefenokee Swamp: Billy's Id., Dec., 1913. One male.

Euryurus louisiana sp. nov.

In general appearance much like Euryurus erythropygus (Brandt) but appearing somewhat more slender and with the red carinæ more elevated. The carinæ have the tooth at the anterior corner proportionately larger and caudad of this less bulging ectad, the swollen border narrowing cephalad as in *erythropygus;* the caudal margin of the anterior somites is wholly smooth, not so irregularly crenulate or bluntly denticulate as usual in the latter species. The vertigial sulcus of the head ends in a rather deep depression at the level of the upper edges of the antennal sockets.

The gonopods of the male are strikingly different from those of erythropygus. The proximal division of each is very short, subcylindrical and glabrous. The distal division about its stouter proximal end extends at an angle ventrocaudad as a stout subcylindrical body which is subtruncate at the free end, which is darker and more highly chitinized; distal end concavely depressed or grooved, with a short, blade-like branch arising from the dorsomesal corner and curving a little dorsad of ectad above the main branch, the outer edge of which it does not reach. The enlarged base of the distal division is concavely depressed on its mesal surface, the depression densely clothed with long bristles. Midway between this basal depression and the distal end is a smaller depression similarly setose. The division is also less densely setose over the remaining surface excepting the chitinous distal end.

Length about 25 mm.

Locality.—La.: Creston. Feb. 27, 1915. One male. Also two broken females taken March 5, 1915.

Euryurus erythropygus (Brandt).

Several specimens taken near Creston, March 5, 1915.

Fontaria lampra sp. nov.

This species seems nearest to *F. bimaculata* (McNeil), described from Pensacola, Fla. The male gonopods are in general similar but the proximal common stalk of the principal, bifurcate spine, is relatively much longer, being as long as or longer than the branches; the shorter or inner branch is much broader, being as broad as the other, is slightly clavately expanded and at tip narrowed to a straight acute process, which does not curve toward the other branch. The process as a whole is bent upon itself almost at right angles at the level of bifurcation. The anterior or basal spine which in *bimaculata* is nearly as long as the principal one, in the present species is very much shorter, less than half as long, slender, acute, moderately curved.

The color is a very dull brown, the carinæ somewhat lighter, though not much contrasting in the types. In some the color is deep, almost black, with the carinæ not paler. A mid-dorsal dark stripe shows in some.

The processes of the second coxæ in the male, slender, cylindrical, moderately long. Coxæ and ventral plates unarmed.

Vertex with two setigerous foveolæ on each side.

Length of male type, 38 mm.; width, 7.3 mm. Length of a female, 50 mm.; width, 9.2 mm.

Locality.—La.: Creston. Type and three other specimens taken March 26, 1915. Several other specimens taken on other dates in March.

Fontaria clara sp. nov.

This form is characterized in having the gonopods of the male of a very distinct type. The proximal end of the second or principal division of each gonopod is densely hirsute; the blade is in two branches, which are smooth and strongly chitinous; of these the ectal one curves first proximad (dorsad) on the ectal side of base and then bends in a semicircle and extends ventro-caudad subparallel with its basal portion, and is distally acutely acuminate; the mesal branch is larger and extends ventrad or ventrocaudad in general, with a slight double or sigmoid curve, the tip, which is flattened from side to side and is acute, weakly hooked or recurved. The basal process springs from the dorsomesal side of the base of the principal process; proximally it is flattened and narrows to an acute tip distad, somewhat twisted and crossing over the process from the other side, much shorter than the other processes.

When in full color the dorsum is very dark, black or nearly so, with the carinæ sharply contrasting by their lighter, in preserved specimens yellowish color. First tergite lighter along anterior border, but not along the posterior. Under surface and legs yellowish.

Vertigial foveolæ two on each side. Vestigial sulcus ending below at the angle of an inversely v-shaped transverse sulcus between the antennæ.

Sternites unarmed. Processes of coxæ of second legs in the male stout, clavate, distally truncate.

Locality.—La.: Creston. Type, a male, taken March 5, 1915. Other specimens taken Feb. 25, 27 and 28, and March 21, 1915.

Polydesmus serratus Say.

Several specimens taken in February, March and May, 1915, near Creston, La.

Polydesmus sp.

One broken specimen, not fully mature and of uncertain species, taken in Mixon's Hammock, Okefenokee Swamp in June, 1912.

Nemasoma pium sp. nov.

This is a much larger species than the *minutum* of Brandt, so common in the northeastern states, the type being near 25 mm. in length, with a diameter of 1.6 mm.

The general color is brown, with a distinct middorsal longitudina black line and a series of black dots along each side over the repugnatorial glands. The posterior region of each segment is darker than the anterior and a line along the suture is blackish. No light areas, such as occur in *sayanum*.

Repugnatorial pores large, each contiguous with the suture, which is moderately curved about it.

The lower end of the first tergite on each side narrows to an acute angle just above which the anterior edge is moderately incurved.

The last tergite exceeds the anal valves. It narrows subtriangularly but is distally truncate, or very obtusely rounded, differing in this conspicuously from that of *minutum* and approaching that of *sayanum*.

Locality.—La.: Creston. March 21, 1915. One female.

Parajulus robustior sp. nov.

This is an exceptionally robust species. The general color is brown, each somite showing near its middle a solid annulus of a deeper, somewhat chestnut, color, and in front of this above and separated from it by a narrow pale stripe, a blackish band enclosing a series of light dots, while the anterior border above the level of the pores is bluish. There is a broad black band connecting the eyes. There is a median dorsal longitudinal black line and a series of small black dots along each side (the repugnatorial glands).

The cardo of the mandibles in the male strongly produced ventrad, attaining to near lower level of labrum.

Each segmental suture is strongly angularly at the level of the pore. A characteristic feature is presented in the last tergite, which exceeds the anal valves, being produced into an acute spine, which is strongly, evenly decurved in the male, less so in the female; this spine proportionately much shorter than in *canadensis*.

The first tergite in the female is angular below, but in the male the lower border is long, the edge horizontal. Strongly margined below. Without distinct striæ. Other segments strongly striate below. The second tergite in the female much extended below level of the first. In the male the second and third tergites are strongly angularly extended into a ridge along the lower level of each side.

The first legs of the male are strongly crassate, unusually long and strongly hooked.

Promentum of gnathochilarium in male much enlarged; oblong elliptic in form.

The species seems to be strongly distinct in the structure of the male gonopods. The sixth and seventh segments are moderately extended below. Of the anterior gonopods the anterior process on each side is strongly clavate, the distal portion above its base subconical, apically narrowly rounded, bearing distally numerous long hairs. The posterior division is a stout, thicker and longer process; it is furrowed across the apex and down the caudal side and is bent moderately cephalad at the tip; the process is glabrous. The principal process of each posterior gonopod is a blade flattened from side to side and curving back caudad below the groove in the posterior piece of the anterior gonopod; it is not distally acute and is without branches or processes; it bears the seminal duct, which opens above a little proximad of the tip. A much smaller, straight, distally pointed process extends ventrad on the ectal side of the base of the principal process, its tip not attaining the lower level of the latter.

Length of a female near 53 mm.; width, 3.5 mm.

Locality.—La.: Creston. One specimen each on February 22, February 28 and March 5 (male, type) and two without date.

Cambala annulata (Say).

Numerous specimens taken near Creston, La., in February, March and May, 1915.

Spirobolus marginatus (Say).

One small specimen taken on Spring Creek, Ga., Aug. 27, 1913. Also three specimens taken near Creston, La., in March and April, 1915.

Spirobolus paludis sp. nov.

This species in comparison with *S. marginatus* is distinguished in general appearance by its coloration, the sides contrasting through their paler brownish color with the mainly blackish dorsum, the black band across each somite covering the entire width dorsally, but narrowing down each side along the anterior margin and ending in a very acute point ventrally. The first dorsal plate is narrowly margined with a lighter color, both anteriorly and posteriorly and the other somites of the anterior region are margined caudally with lighter color, the marginal stripe obscure or absent dorsally in middle and posterior regions.

The antennal furrow on head below eye and across cardo of mandibles much shallower and less sharply limited than in *marginatus*, with no trace of the ridge bordering the furrow on the cardo ventrally though the ridge on the caudal side is present. Cardo lacking the small, very acute ventrodistal process seen in the male *marginatus*.

Second segment much less produced below the first plate than in *marginatus*, not at all extending below level of general ventral surface of the segment and not much lower anteriorly than posteriorly.

The modifications of the anterior legs in the male are very obviously different from those in *marginatus*. The first two pairs of legs are smaller in size than the others. The third pair of legs show ventrally a pair of rounded processes contiguous at the middle line, and bearing distally two or three long setæ. The coxal processes of the fourth legs are higher and more narrowed distad, each bearing at apex a much narrower and paler mammiliform process. The coxal processes of the fifth pair are much longer, above base subcylindric, a concave depression on each side in an oblique anter-distal face. The processes of the sixth legs are somewhat shorter and each is cupped or concavely depressed on its distal end. The coxal processes of the seventh legs are much the largest; each broadly and deeply concave on its anterior face.

Repugnatorial pore in front of suture which it does not touch: the suture angularly bent cephalad just above the level of the pore.

Number of somites 49-50. Length of the male (type) 45 mm.; diameter, 5.2 mm. A female paratype much larger with the dorsal transverse bands blacker and more sharply defined: length about 95 mm., with the width 8 mm.

Locality.—Ga.: Okefenokee Swamp: Mixon's Hammock (male type), June, 1912. The female was labeled simply "Okefenokee Swamp."

CHILOPODA.

Cryptops hyalinus Say.

Seven specimens taken in the Okefenokee Swamp, one in Mixon's Hammock, June, and six on Billy's Id., July, 1912. Also four specimens taken near Creston, La., in February and March, 1915.

Otocryptops sexspinosus (Say).

Numerous specimens taken near Creston, La., in February and March, 1915.

Theatops posticus (Say).

Several specimens taken in the Okefenkoee Swamp: Minnie Lake Run, June 14, one specimen; Billy's Id., June, six specimens; and four in Mixon's Hammock, June 5, 1912. Also five specimens taken near Creston, La., in February and March, 1915.

Scolopendra viridis Say.

One specimen taken near Creston, April 20, 1915.

Scolopendra heros Girard.

Two specimens taken near Creston, May 1, 1915.

Hemiscolopendra punctiventris (Newport).

Five specimens taken on Billy's Id., Okefenokee Swamp, in June, 1912, and Dec., 1913. Also fourteen specimens taken near Creston, La., in March and April, 1915.

Linotaenia fulva (Sager).

One specimen taken at Creston, March 9, 1915.

Arenophilus bipuncticeps (Wood).

One specimen from near Creston, La.

Arenophilus watsingus Chamberlin.

One specimen from near Creston taken May 5, 1915.

Geophilus mardax Meinert.

One specimen from near Creston, April 2, 1915.

Nannocrix gen. nov.

Frontal suture not present. Prebasal plate developed and exposed. Basal plate trapeziform, narrowed cephalad.

Labrum free, tripartite. Lateral pieces armed with long spinous processes.

First maxillæ with coxæ completely fused at middle and separated by suture from the distal divisions. Palpi biarticulate, the coxæ and femora with long membranous lappets at distal external angles.

Coxæ of second maxillæ completely fused. No trace of pleurosternal sutures. Palpus triarticulate; femur without distal process; claw simple.

Coxosternum of prehensors with strongly developed and complete chitinous lines. Prehensors short, not attaining front margin of head; articles wholly unarmed within.

Dorsal plates strongly bisulcate.

Ventral pores on anterior plates in a transverse band in front of caudal margin and in two small anterior areas, one in each anterolateral corner. Anterior areas may disappear in caudal region, where pores of posterior band are also fewer and may be divided into two areas.

Last ventral plate very wide. Coxopleural pores few, obscure, covered by plate.

Anal pores absent.

Anal legs unarmed, the claw being replaced by a minute, transparent terminal article.

Type.—Nannocrix porethus sp. nov.

Nannocrix porethus sp. nov.

Body moderately attenuated cephalad of middle, more strongly so caudad.

General color yellow, becoming dilute ferruginous in the anterior region and sometimes in the extreme posterior, the head deeper ferruginous. Antennæ and legs yellow.

Cephalic plates short, equal in length and breadth. Greatest width near junction of posterior and middle thirds of length. Sides convexly rounded; caudal margin incurved; anterior margin in the form of a very obtuse angle. Sparsely and uniformly hirsute.

Basal plate trapeziform, the anterior margin widely evenly concave. About one-third as long on median line as the cephalic plate; three and a half times as wide as length at middle.

Antennæ moderately short, three times as long as the cephalic plate. Attenuated distad. The ultimate article equal in length to the two preceding taken together. Proximally sparsely hirsute, becoming densely so distad with the hairs shorter.

Prosternum much wider than long (21:13). Anterior margin forming a very obtuse re-entrant angle with the edge smooth and strongly chitinized except at middle. Joints of prehensors very short, the distal end of the first one on the mesal side scarcely cephalad of the anterior edge of the prosternum. Claws when closed, falling much short of attaining the front margin of head. All joints wholly unarmed.

Prescuta in middle region a half or a little more as long as scuta, becoming very short cephalad and in the extreme posterior region.

First four spiracles broadly vertically elliptic, the others circular; decreasing in size gradually from the first, which is large, caudad.

First legs much reduced in size, the second ones being abruptly longer and stouter. Posterior pairs proportionately more slender than the anterior and much longer.

None of the ventral plates at all sulcate. Ventral pores in anterior region distinct and numerous, forming a continuous transverse band posteriorly, which may extend slightly forward at the middle and a small subcircular area in each anterior corner. Posteriorly the anterior areas disappear and the pores of the posterior band become few and less distinct.

Last ventral plate very wide, wider than the preceding sternite. Sides strongly convex, converging caudad. Caudal margin straight. Coxopleural pores obscure, covered by the ventral plate.

Anal legs much longer and stouter than the penult in both sexes. The sixth article abruptly much more slender than the fifth, the appendage replacing the claw minute.

Pairs of legs, 61-63.

Length up to 45 mm.

Locality.—La.: Creston, March 5, March 9, and March 20, one specimen being secured on each of these dates.

Helembius gen. nov.

Of the genera of smaller lithobiids previously known to occur in the southeastern United States this genus is like *Nampabius* and *Garibius* in having the number of articles in the antennæ definitely fixed at twenty. It differs from those genera in having the anal and penult legs of the male simply inflated and wholly without special lobes on either pair. In the sparse development of spines on the legs and their complete absence from the coxæ, the type species suggests *Nampabius*, which differs, aside from the possession of the highly characteristic lobe on the penult legs of the males, in the characteristic U-form of the median incision of the prosternum and in the small, not enlarged, single ocellus.

In the general character of the spining of the legs the new form almost fully agrees with *Sigibius* occurring in the New England States; but the latter genus has the number of articles of the antennæ twenty five. The body is slender and only slightly narrowed cephalad. First tergite narrower than head and than the third tergite.

Antennæ short; articles twenty.

Ocelli few, in two, or irregularly in three, series; the single ocellus enlarged.

Prosternal teeth 2+2, the line of apices distinctly recurved. Median incision acute at bottom, V-shaped.

None of the dorsal plates at all produced. The posterior corners of the ninth, eleventh and thirteenth plates moderately oblique or excised.

Coxal pores small, circular, few, uniserrate.

Claw of female gonopods tripartite; lobes small, the lateral subequal. Basal spines 2+2, moderately stout, though less so than in *Tidabius*, the sides from base to apical division parallel, the apical acuminate part very short.

Coxæ of legs all wholly unarmed. Claws of anal and penult legs two. Ventral spines of anal legs, 0, 1, 1, 1, 0; dorsal, 0, 0, 2, 0, 0, (female) or 0, 0, 1, 0, 0, (male). Ventral spines of penult legs, 0, 1, 1, 1, 0; dorsal, 0, 0, 1, 0, 0.

Anal legs of male short, strongly and uniformly inflated; the penult legs more moderately inflated, the tarsal joints slender; both pairs wholly lacking special furrows or processes.

Very small, the type species near 6 mm. (female) or less (male) in length.

Type.—Helembius nannus sp. nov.

Helembius nannus sp. nov.

General color brown of slight chestnut tinge, the head more deeply colored. Antennæ paler, yellowish at tips. Legs yellow, but the posterior pairs darker, excepting the tarsi, which are bright orange or yellow.

Head much wider than long (about 34:25). Hairs sparse, of moderate length. On caudal portion two sublongitudinal impressions diverging cephalad.

Antennæ very short; articles, excepting second and ultimate, very short, the ultimate equalling the two preceding taken together. Hairs, excepting the proximal articles, dense, of moderate length, setose.

Ocelli in female type six or seven in number, thus, 1+2, 3 or 1+2, 3, 1. The single ocellus greatly exceeding the others in size, subvertically elongate, and the ocelli of the upper series exceeding those of the lower.

Prosternum 1.5 times wider than long. Distance between chitinous spots near 3.57 times the dental line. Outer prosternal tooth on each side extending farther forward than the mesal one, making the line of the apices decidedly recurved. Sides slanting directly from the ectal tooth, a little incurved.

First dorsal plate 1.7 times wider than long, widest anteriorly; sides converging caudad, evenly convex. Posterior corners of ninth and eleventh dorsal plates distinctly obliquely excised more on caudal side, those of the thirteenth plate less distinctly so.

Coxal pores small and circular; 2, 3, 3, 2.

Spines of anal legs, $\frac{0, 0, 2, 0, 0}{0, 1, 1, 1, 0}$ or $\frac{0, 0, 1, 0, 0}{0, 1, 1, 1, 0}$ (male), claws 2; of penult. $\frac{0, 0, 1, 0, 0}{0, 1, 1, 1, 0}$, claws 2; of thirteenth, $\frac{0, 0, 1, 0, 0}{0, 0, 1, 1, 0}$; of the twelfth $\frac{0, 0, 0, 0, 1}{0, 0, 1, 1, 0}$; of the tenth, $\frac{0, 0, 0, 1, 1}{0, 0, 1, 1, 0}$.

Claw of female gonopods of uniform width, tripartite, the lobes very short, the lateral equal and the median one but little exceeding these. Inner and outer basal spines equal or very nearly so; acuminate distal division very short, subobtuse.

Length of female, 6 mm.; of male only 4 mm.

Locality.—Ga.: Okefenokee Swamp; Billy's Id., June, 1912. One female and one male.

Neolithobius helius sp. nov.

General color of dorsum brown, the head chestnut. Antennæ chestnut, paler, yellowish, distally. Legs yellowish, the posterior pairs darker, brown to chestnut, but with the distal joints bright orange or yellowish.

Head subcordate, but anteriorly truncate between the antennæ and the caudal margin excepting at ends straight or nearly so. Wider than long in the ratio 7.5:6.

Antennæ moderately long, reaching to the seventh pediferous segment. Articles typically from thirty to thirty-three in number, short and very short, the ultimate variable in proportionate length, sometimes equalling the two preceding ones and sometimes much shorter. Subdensely setose distally, more sparsely setose proximally.

Prosternum with distance between chitinous spots three times the length of the dental line. Lateral sloping margins conspicuously incurved. Prosternal teeth mostly rather small, mostly 5+5, but also 5+6, 6+6, 6+7, and 7+7, the most mesal teeth on each side often much reduced and lower in position. Mesal incision very narrow.

Ocelli forming a compact oblong area. Ocelli arranged mostly in four to six longitudinal series with the single ocellus much larger, pale: e. g., one 6, 5, 5, 4, and one 6, 7, 6, 5, 3.

First dorsal plate across its anterior end only a little narrower than the head and equal in width to the third plate.

Coxal pores very small, circular. Examples of arrangement and number: 4, 5, 5, 4; 5, 6, 6, 4.

Spines of the anal legs $\frac{1, 0, 3, 1, 0}{0, 1, 3, 3, 2}$, claw single; penult, $\frac{1, 0, 3, 3, 1}{0, 1, 3, 3, 2}$, claw single; thirteenth, $\frac{1, 0, 3, 2, 1}{0, 1, 3, 3, 2} - \frac{1, 0, 3, 2, 2}{0, 1, 3, 3, 2}$; twelfth, $\frac{1, 0, 3, 2, 2}{0, 0, 2, 3, 2}$; second to eleventh, $\frac{0, 0, 3, 2, 2}{0, 0, 2, 3, 2}$; first, $\frac{0, 0, 3, 2, 1}{0, 0, 2, 3, 1}$. Last three pairs of coxæ laterally armed.

Claw of female gonopods rather small, tripartite, the lobes acute, the median obviously longer and stouter than the others. Basal spines 2, 2; moderately slender, in ventral view with sides parallel to acute distal portion.

In the male the anal legs have the third article strongly clavately enlarged distad of the base, the thickening chiefly represented by a high ridge situated dorsomesally and bearing distally a stout spine bifid serrate at the apex somewhat as in *xenopus*, and a patch of long bristles. This rounded, ridge-like lobe extends mesad well beyond inner side of the succeeding or fourth article. Fourth article conspicuously excavated and longitudinally furrowed along the dorsomesal surface as usual, but the joint as a whole not bowed; at ends and along sides of furrow are long setæ.

Length 14 to 18 mm.

Locality.—Okefenokee Swamp: Billy's Id., nine specimens taken in June; and Honey Id., three specimens taken May 31 and June 1, 1912.

Neolithobius mordax (L. Koch).

One specimen, with head missing, referable to this species taken at Creston.

Neolithobius transmarinus (L. Koch).

Numerous specimens taken in February and March, 1915, near Creston, La.

THE PHLEPSIDS OF MEXICO AND CENTRAL AMERICA.*
(HOMOPTERA CICADELLINÆ)

By E. D. Ball.

Genus **Phepsius** *Fieb.*

This genus was erected by Fieber for a small number of European leaf hoppers with vermiculate brown or dark lines inscribed on the elytra and usually with similar markings throughout.

This group reaches its highest development in the temperate region of North America. Only a small number of species extend into the more tropical regions and most of these are found in the mountains of central and southern Mexico, while no species is known from Central or South American regions.

The vermiculate lines will serve to separate nearly all of the species of the group, while the remainder show such evident relationship that they are easily placed. A few have lost these vermiculations by reduction in number, while others have lost them by the gradual substitution of dots in their place.

The following subgenera are represented in the North American fauna:

KEY TO THE SUBGENERA OF PHLEPSIUS.

a. Head distinctly narrower than the pronotum; the lateral margin of pronotum strongly carinate, long, nearly equaling the short diameter of the eye.
  b. Head much narrower than pronotum, which is produced between the eyes; vertex and front long and narrow; large active species with long narrow elytra...*Iowanus* nov.
  bb. Head slightly narrower than pronotum which is regularly rounding in front; front broader above; shorter and stouter species..........*Texananus* nov.
aa. Head conical, about equaling pronotum; lateral margin of pronotum almost obsolete, never more than one-fourth the short diameter of the eye; elytra usually with an angular pattern on inner part; outer margin pale, often with four definite spots.......................................*Dixianus* nov.
aaa. Head as wide or wider than pronotum; lateral margin of pronotum carinate, one-third the short diameter of the eye or longer; elytra with pattern transverse or wanting.
  b. Front margin of head not produced or foliaceous.
    c. Vertex long and flat; front flat in profile, meeting vertex in acute angle; margin blunt.......................................*Zioninus* nov.
    c. Vertex short; front sloping, convex, thin; margin rounding or acute, but not produced.......................................*Phlepsius* Fieb.
  bb. Front margin of head produced, foliaceous..........*Paraphlepsius* Baker

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* The writer was asked to undertake the Jassidæ of the Biologia Centrali-Americana in 1902. The material arrived in very poor shape, but the work was taken up and more than half completed in the course of the next three years, including the figuring of many species by Mrs. Ball. A change to executive work at that time reduced the time possible to give to this material and so the work was not completed at the date the editors set for the close of the Homoptera volume. The writer then decided to publish his studies of the groups from time to time, as opportunity offered, after which the material will be returned to the Biologia collection.

Subgenus Iowanus nov.

Resembling *Phlepsius* but with head much narrower than pronotum vertex narrow, disc flat, front long and narrow, but slightly widening above. Pronotum large, pushed forward between the eyes, the lateral margins long and strongly oblique. Elytra very long and narrow, over one-third their length beyond clavus; central apical cell long curved, narrow at base. Surface of elytra regularly inscribed with vermiculate lines.

Type of the subgenus *Phlepsius* (*Iowanus*) *handlirschi*, n. sp.

This subgenus is remarkably distinct in the narrow head, front, and extraordinarily long elytra. It will probably be given generic rank later. *Phlepsius majestus* Osborn and Ball, which occurs in the central and southern United States, also belongs to this group. This species, together with the three following, form a striking series of large, showy forms that at first sight are often mistaken for tawny members of the genus *Gypona*.

KEY TO THE SPECIES OF IOWANUS.

a. Vertex flat, the light margin narrow......................1. *elongatus* n. sp.
aa. Vertex convex, the light margin broad.
  b. Tawny, length 8½ mm. or over.
    c. Female segment with a broad, short notch without teeth.
      2. *hebraeus* n. sp.
    cc. Female segment with a deep narrow median slit with marginal teeth.
      3. *handlirschi* n. sp.
  bb. Grayish or cinereous; length 7.5 mm. or less; female segment with a triangular notch and prominent teeth..........................4. *spatulatus* V. D.

Phlepsius (*Iowanus*) **elongatus** *n. sp.* (Fig. 1a and b).

Resembling *majestus* but narrower with a longer, flatter vertex and a long acuminate female segment. Length of female, 10 mm. Vertex transversally depressed, nearly flat on anterior half, acutely angled with the long narrow front, one-third longer on middle than against eye, half wider than long. Pronotum much wider than vertex, the outer angles prominent. Elytra very long and narrow.

Color. Vertex pale testaceous; the anterior third black except for a narrow light margin and a median line; a spot against either eye near the base and an irregular band on middle brownish or fuscous. Front pale with fuscous arcs, the upper pair very distinct and margining the vertex, below they coalesce into an irregular spot on the disc. Pronotum pale, irregularly mottled with brown, three fairly definite fuscous spots on the anterior sub-margin behind each eye. Scutellum fulvous with six light points. Elytra pale, fulvous, uniformly inscribed with testaceous.

Genitalia. Female segment continuing full width as long as the penultimate, then tapering into a long, slender point extending almost to apex of pygofers.

Described from a single female from Amula Guerrero, Mex. (H. H. Smith). This is a strikingly distinct species in many characters and unique in the genus in the elongate female segment.

Phlepsius (*Iowanus*) **hebraeus** *n. sp.* (Fig. 2a and b).

Resembling *handlirschi* in general form and appearance, slightly smaller; color and marking similar but slightly paler. Length 8.5-9 mm.; width, 3 mm. Vertex transversely convex, one-fourth longer on middle than against eye, twice wider than long, the anterior margin bluntly rounding to front; front long and narorw, the margin straight to just before the apex. Pronotum broad, the outer angle sharp. Elytra long and narrow; the anteapical cells parallel margined, a number of extra cells on the costa opposite the anteapicals.

Color. Vertex and face marked as in *handlirschi* and *majestus*. Pronotum pale, irrorate with brown and with a few black spots along the anterior sub-margin. Elytra as in *handlirschi* but lacking the rufous cast and usually with a few definite light spots in the apical cells.

Genitalia. Female segment moderately long, posterior margin slightly concave with a small semi-circular median notch.

Described from eight females, one from Vienna Museum, labeled "Mexico, Coll. Sign. *Jassus hebræus* Stal (*hebræus* det. Sign)," and seven from Amula Guerrero Mex. (H. H. Smith).

Phlepsius (*Iowanus*) **handlirschi** *n. sp.* (Fig. 3b, c, and d).

Form and general appearance of *majestus* Osborn and Ball. Slightly smaller and with a narrower vertex. General color, fulvous brown. Vertex pale yellow with a broad band and two sub-apical spots black. Length 9-10 mm.; width 3-3.5 mm. Vertex and face as in *hebræus*. Elytra slightly broader and less flaring, second and third apical cells long and curved.

Color. Vertex pale yellow, a transverse band behind the ocelli widening on the disc and interrupted in the middle, and a pair of spots in front of this, black; this band incloses a yellow dot against each eye. Face pale sordid yellow. Short brown arcs on front and a dark ocellate spot on clypeus. Pronotum pale, coarsely irrorate with fulvous brown, the anterior sub-margin with coarse ocellate dark spots. Elytra pale, rather sparsely inscribed with fulvous; three dark spots along the suture.

Genitalia. Female segment short, transverse; posterior margin, nearly straight, the median third produced on each side of a narrow median notch extending over half way to the base; angles next this notch acute. Male valve semi-circular, plates long, acutely triangular, the extreme tips rounding, three times as long as the valve.

Described from three females and one male from Omilteme and Xucumanatlan in Guerrero (H. H. Smith) and Ciudad Mex. (Forrer). One female from Vienna Museum, labeled "Mexico Coll. Sign. (*hebræus* det. Sign.) (114)," which is slightly darker than the rest but does not differ otherwise.

Phlepsius (*Iowanus*) **spatulatus** *V. D.* (Fig. 4b and c).

This is a smaller, paler, and less definitely marked species, occurring commonly from Colorado south to Central Mexico. Specimens are at hand from Mexicali, June; Ti-Juana, August (Ball); El Taste and Presidio Mex. (Forrer). The short teeth on the female segment separated by an acute notch will readily separate this species from any other.

Subgenus Texananus nov.

Resembling *Phlepsius* but with head narrower than the pronotum, front rather broad, convex, widening above the antennæ and approaching the eyes. Vertex bluntly conical, the margin to the front rounding. Pronotum large, broadly and evenly rounding in front; the lateral margin long, oblique, and definitely carinate. Elytra broader and shorter than in *Iowanus*, whole surface inscribed with vermiculate lines. Type of the subgenus *Phlepsius* (*Texananus*) *mexicanus* n. sp.

KEY TO THE SPECIES OF TEXANANUS.

a. Sutural margin of elytra not definitely marked with light.
  b. Elytra uniformly irrorate.
    c. Length 7 mm., female segment excavated to base......5. *eugeneus* n. sp.
    cc. Shorter, female segment excavated half way to base....6. *superbus* V. D.
  bb. Elytra with irregular areas of dark and light..........7. *mexicanus* n. sp.
aa. Sutural margin of elytra definitely light marked.
  b. Vertex, pronotum and scutellum each with a pair of black dots.
8. *excultus* V. D.
  bb. Without definite black dots.
    c. Vertex dark brown, nearly flat..............................9. *hosanus* n. sp.
    cc. Vertex cinereous, convex; species small...............10. *ovatus* V. D.

Phlepsius (*Texananus*) **eugeneus** *n. sp.* (Fig. 5b and c).

Nearly of the form of *excultus* but larger, paler, and lacking the definite markings of that species. Pale grayish or slightly fulvous brown. Length 7 mm., width 3 mm. Vertex convex, one-fourth longer on middle than against eye, twice wider than long. Anterior margin bluntly rounding except at apex, front broader than in *hebræus*, almost parallel margined until just before the apex. Pronotum but little wider than across eyes. Elytra longer than in *excultus*, flaring behind, inner anteapical cell very long, the outer one broadest in front.

Color. Pale yellow, two pairs of approximate dots on suture between vertex and pronotum as in *excultus*, two indistinct brown spots at apex of vertex, and front brown with pale dots. Elytra milky, inscribed with brown, faintly washed with rufous in most specimens, the tips of the claval nervures fuscous.

Genitalia. Female segment long, angularly narrowing posteriorly, middle half roundingly emarginate clear to the base where there is a slight median tooth. Male valve very short and obtuse; plates large, triangular, with nearly straight margins, white with black spots at the base of the short marginal hairs; the stout spines of the pygofers exceeding those of the plates.

Described from twelve specimens from Acuguizotla, Guerrero, 3,500 ft. Oct. (H. H. Smith); Amula, Guerrero, 6,000 ft. Sept. (H. H. Smith); Das Arroyos, Guerrero, 1,000 ft. Sept. (H. H. Smith); Tierra, Colorado, Guerrero, 2,000 ft. Oct. (H. H. Smith); Cuernavaca, May; and Iguala, Mex.

This species may be separated from *excultus* by the absence of definite fulvous and wavy markings along the dorsum, as well as by the much longer notch in the female segment, and from *spatulatus* which it resembles by the distinct genitalia.

Phlepsius (*Texananus*) **superbus** *V. D.* (Fig. 6b and c).

This compact, dark brown species much resembles *mexicanus* but is slightly smaller and more elongate. The very dark face and distinct genitalia will readily distinguish it.

It occurs from Colorado and Oregon south to Central Mexico. Specimens are at hand from Ti Juana, June (Ball) and Mescala, Guerrero Mex. (H. H. Smith).

Phlepsius (*Texananus*) **mexicanus** *n. sp.* (Fig. 7a, b, c, d and e).

Closely resembling *P. areolatus* but quite distinct in shape of vertex and genitalia. A stout species with the brownish fuscous irrorations irregularly distributed, leaving patches of milk white. Length 6.75 mm., width 3 mm.

Vertex convex, with the front almost conical, nearly half longer on middle than against eye, almost three times wider than long, front broad wedge-shaped but little longer than its basal width. Elytra broad and short, the apices appressed; apical cells short.

Color. Vertex testaceous brown, three irregular blotches on the anterior margin and numerous dots on the disc pale; pronotum testaceous brown, with irregular hieroglyphic light markings on anterior half and light pustulate spots on the remainder. Scutellum with the apex and two marginal spots light. Elytra milky white, the nervures fuscous brown, the vermiculation mostly coalesced into fuscous dots which are larger toward the margins.

Genitalia. Female segment reduced, less than two-thirds as wide as the penultimate, consisting of an obtusely triangular plate with the apex produced into a strap-like tooth as long as the segment. A pair of broad plates arising under this segment cover the base of the pygofers and a pair of heavy folds occupy the corners. Male valve rounding, plates narrow, scarcely as wide as the valve, concavely narrowing to the blunt points, two and one-half times as long as the valve, not quite as long as the compressed pygofers.

Described from seven specimens from Orizaba, December (H. S. and F. D. G.); Chilpancingo, Mex., June, (H. H. S.); and one female from Vienna Museum labeled *mexicana* det. Sign.

Phlepsius (*Texananus*) **excultus** *Uhl.* (Fig. 8a, b and c).

This strikingly marked species resembles *eugeneus* in structure and *decorus* in markings but the fulvous dorsum and commisural line will at once distinguish it. It ranges through the southern United States and a single specimen is at hand from Puentad, Ixtla, Mexico, July (C. C. Deam).

Phlepsius (*Texananus*) **hosanus** *n. sp.* (Fig. 9a and b).

Form and general appearance of *decorus* O. & B. slightly smaller and with a definite concave light line between the ocelli. Length 6 mm., width 2½ mm.

Vertex transversely convex, slightly sloping to the narrow margin, one-fifth longer on middle than against eye, twice wider than long. Front moderately broad above, wedge shaped, distinctly longer than wide. Pronotum but little wider than across the eyes. Elytra longer and more flaring than in *decorus.*

Color. Vertex brownish fuscous; a spot at apex, the line between ocelli and the base ivory white. Pronotum with tawny markings on the anterior third. Scutellum tawny with light and black spots. Elytra ivory white, with fuscous irrorations coalescing into irregular spots omitting the inner margin back to apex of clavus. This ivory margin is narrow next the scutellum and is crossed by the inner claval nervure. It widens out on middle of clavus and again before apex and usually bears one or more black spots in each expansion.

Genitalia. Female segment short, posterior margin nearly truncate with four triangular teeth on the middle third, the outer pair the larger.

Described from two females, from Orizaba, Dec., (H. S. and F. D. G.); and Tepetlapa Guerrero, Mex., Oct. (H. H. S.). The broad, stout form and the dark color within the median ivory spots render this an easily recognized form.

Phlepsius (*Texananus*) **ovatus** *V. D.* (Fig. 10a, b and c).

This is the smallest species of the group in Mexico and its small size, oval shape, and pale commisural line will at once distinguish it.

It ranges from Oregon and Colorado south to southern Mexico. Specimens are at hand from Cuernavaca, Morelos (H. H. S.); Jalapa, Vera Cruz, June; Aumlema, 535 ft., (Barrett); and Ti Juana, August, (Ball).

Subgenus Dixianus nov.

Resembling *Phlepsius* but with the head about equaling the pronotum in width; the lateral margin of pronotum very short, sub-obsolete, scarcely carinate; vertex flat or sub-conical, rather narrow, the width of head made up by the long diameter of eye which is nearly as great as the width of vertex; front long, convex margin, forming a regular curve to ocelli which are large and touch the eye; eyes wider than genæ; clypeus long, narrow, and very slightly constricted. Elytra long and narrow, venation obscured by the pattern, the central apical cell long and narrow, slightly curved, the outer anteapical broad at base, often acuminate with several supernumerary cells at apex, the costal margin often broadly light with four black spots; usually an angulate cuttetix-like pattern on the disc.

Type of the subgenus *Phlepsius* (*Texananus*) *utahnus* Ball.

This is a very distinct little group, intermediate in character, between *Eutettix* and *Phlepsius* proper, and it will probably receive generic rank later. Its members can be recognized at once by the sub-obsolete lateral margin of the pronotum, the unusual width of the eyes, the costal spots, and the pattern of the elytra. *P. costomaculatus* is the most common Mexican form and has been figured but *utahnus* is more representative of the group, which includes a number of species from the southwestern United States, such as *pulchripennis* Bak., *loculatus* Ball, *stellaris* Ball, and *floridanus* Ball.

KEY TO THE SPECIES OF DIXIANUS.

a. Vertex short, convex, almost parallel margined; elytra pale, costal spots large..*costomaculatus* V. D.

aa. Vertex definitely angulate, flat; elytra with a heavy pattern and small costal spots..*utahnus* Ball

Phlepsius (*Dixianus*) **costomaculatus** *V. D.* (Fig. 11a, b, c, d and e).

This pale species is the largest one of the group. It occurs in most of the Gulf States region of the United States and is the only one so far known to occur far south of the Mexican border. Specimens are at hand from Teapa in Tabasco, Mexico, February, (H. H. S.).

Phlepsius (*Dixianus*) **utahnus** *Ball.*

Of this beautiful little species which occurs in the southwestern United States a single example has been examined from Commondu, Lower California, Mexico (Haines).

Subgenus Zioninus nov.

Resembling *Paraphlepsius* in general form but without the foliaceous margin to the vertex. Vertex long, flat, rounding or subangulate in front; face almost straight in profile, meeting vertex at an acute angle; the margin blunt and not inclined to be foliaceous; front broad, wedge-shaped, the ocelli distant more than their width from eyes. Pronotum with the lateral margin almost as long as the short diameter of the eye, strongly carinate. Elytra broad, short, apical cells almost quadrangular, venation of disc much obscured by heavy reticulations.

Type of the subgenus *Phlepsius* (*Zioninus*) *extremus* Ball.

The broad, short form of this small species renders it quite distinct in the broad-headed groups, while the large, flat vertex and reticulate venation set it off structurally from all others.

Phlepsius (*Zioninus*) **extremus** *Ball* (Fig. 13a, b, c, d and e).

This species has been found in the United States from Utah to California and south to Mexico. Mexican examples are at hand from Ti Juana, June and August, (Ball).

EXPLANATION OF PLATES.

PLATE XXXIII.

Fig. 1. *Phlepsius (Iowanus) elongatus n. sp.
Fig. 2. Phlepsius (Iowanus) hebraeus n. sp.
Fig. 3. Phlepsius (Iowanus) handlirschi n. sp.
Fig. 4. Phlepsius (Iowanus) spatulatus V. D.
Fig. 5. Phlepsius (Texananus) eugeneus n. sp.
Fig. 6. Phlepsius (Texananus) superbus V. D.
Fig. 7. Phlepsius (Texananus) mexicanus n. sp.

PLATE XXXIV.

Fig. 8. Phlepsius (Texananus) excultus Uhl.
Fig. 9. Phlepsius (Texananus) hosanus n. sp.
Fig. 10. Phlepsius (Texananus) ovatus V. D.
Fig. 11. Phlepsius (Dixianus) costomaculatus V. D.
Fig. 13. Phlepsius (Zioninus) extremus Ball.

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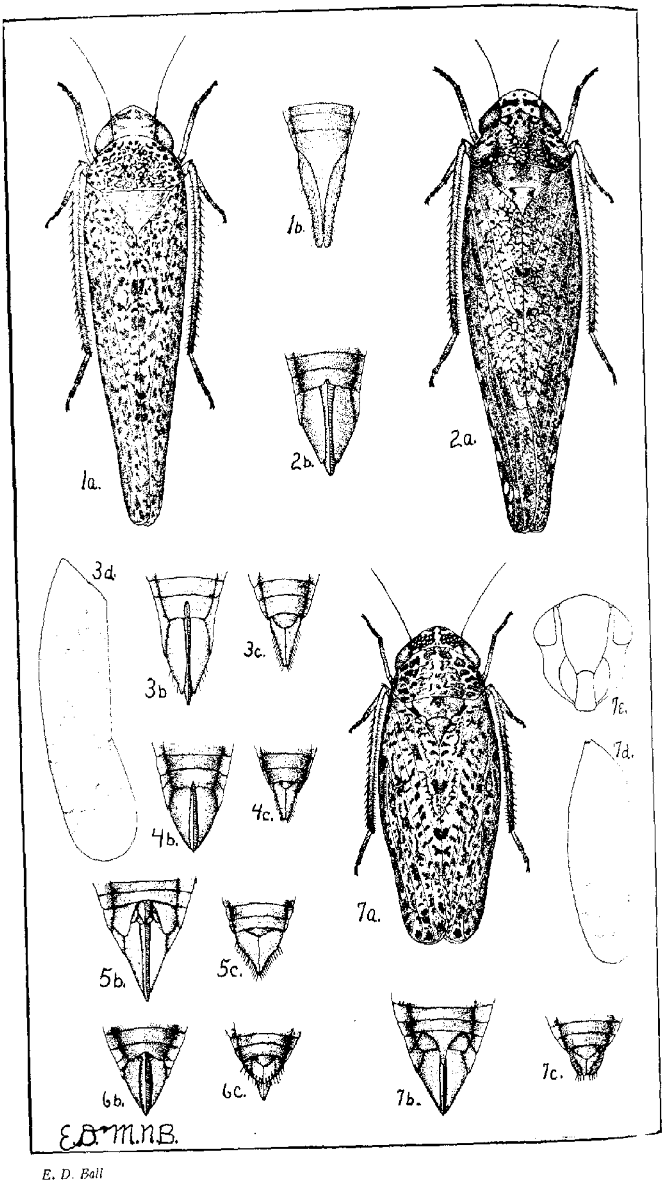
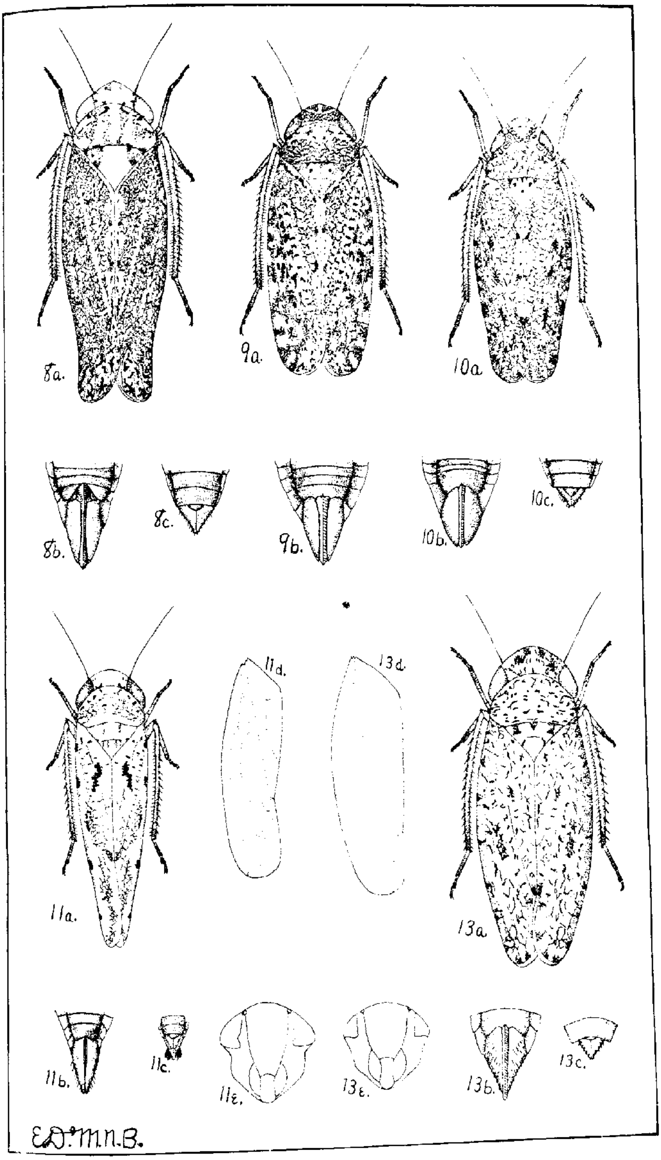
* In all figures *a* refers to adult; b, ♀ genitalia; *c*, ♂ genitalia; *d*, elytra; *e*, face.



E. D. Ball


8a.
9a.
10a
8b.
8c.
9b.
10b.
10c.
11a.
11d.
13d.
13a
11b.
11c.
11e.
13e.
13b.
13c.
ED.M.N.B.

D. Ball

SCIRTES TIBIALIS, GUER., (Coleoptera-Dascyllidæ), With Observations on its Life History.*

WALTER C. KRAATZ.

Scirtes tibialis, Guer., belongs to the *Dascyllidæ*, a comparatively little known family of small, inconspicuous beetles which have not been extensively studied. The adults are technically described, but few of the life histories have been worked out, despite some very interesting larval forms represented in the family. Of these beetles, some (grouped together as the Cyphonides, (13), from the name of the genus Cyphon) have aquatic larvæ, and these are remarkable in possessing long, many-jointed antennæ. Scirtes is of this type.

A search into the literature revealed nothing on Scirtes tibialis, except the description of the adult (4), (5), (1), and only a few scattered notes on the genus, with but one paper dealing with the larva (9), and that the species Scirtes championi. Both Helodes and Cyphon have been the subject of a number of studies, mainly in Europe, and most of the aid relative to the larvæ of Scirtes was obtained from the papers (2, 3, 9, 10, 11, 12) on these related genera.

OCCURRENCE AND DISTRIBUTION.

Although aquatic, the larva is not an open-water swimmer. It has a distribution restricted to that of the duckweed, Lemna minor, its one food plant, which grows commonly in solid areas often of some considerable extent, throughout the summer, in quiet shallow waters of bays along the shores of small lakes, and in suitable permanent ponds, large or small. The material used in this study was obtained principally from a pond northwest of Madison, Wisconsin, and also from such bays along the shores of Lake Mendota and Monona. The larvæ are usually found resting or feeding on the lower surfaces of Lemna leaves.

When crossing small spaces of open water, the larva moves (never more than a few inches at a time) usually with ventral side uppermost, just beneath the surface film. It may also be dorsal side uppermost, especially when swimming down away from the surface. Its motion is a characteristic wriggling one, which is a combination of very rapid leg movements and rapid jerky bendings of the body from side to side. The body movement is the effective factor in the locomotion. Sometimes it suddenly stops in its movement and rests just beneath the surface film apparently as well as beneath leaves. The locomotion of the younger instars differs somewhat, but this is one of the phases that can not be elaborated here.

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* Contribution from the Zoological Laboratory of the University of Wisconsin.

The beetle itself is never aquatic, but is commonly found on grasses and other plants along shores and on the exposed portions of aquatic vegetation, of waters suitable for the larva. The imago is perfectly capable of flying, but is also a remarkably powerful jumper, possessing enormously swollen hind femora. Most of its motion, within its usual habitat, is by jumping.

LIFE HISTORY.

Egg.

The eggs were not found in nature, but many were laid under laboratory conditions by both reared and captured beetles. Whether eggs are normally laid submerged could unfortunately not be determined. I never saw a beetle enter the water to lay eggs, nor deposit them into water, although some dishes were favorably constructed for such procedure. Judging from the immediate water requirements of the young larva, however, it seems an entirely artificial and abnormal condition that all eggs secured were laid by beetles on dry objects, directly on the glass surface or on bits of leaves in small vials (without water) in which many of the beetles were isolated for observation.

Eggs are laid in small, irregular masses, which are stuck to the surface. Of the eggs studied, the first mass was laid during the night of July 5 and hatched July 16, making an egg period of 11 days. The time of oviposition of six other masses was known, but in three of these all the eggs died because of mold. The periods of the remaining ones were 9½, 10½ and 11 days. The eggs of a single mass all hatch within a space of several hours. The egg period is hence 9½ to 11 days.

Larva.

The only young larvæ obtained were from the above mentioned egg masses in the laboratory, and were numbered in groups correspondingly. Records of all of their ecdyses were made and the stadia lengths were noted (in a series of tables) in days, but also in half days and shorter intervals where possible. The average length of the stadia for all the individuals in a group are given in the following table:

GROUP	No. of individuals in group at begin'ng	LENGTH OF STADIA IN NUMBER OF DAYS						
		1st Stadium	2nd Stadium	3rd Stadium	4th Stadium	5th Stadium	6th Stadium	7th Stadium
No. 1	23	3	4	4	8	9	3	8
No. 4	19	2.56	6	6.2	6	6.16	......	......
No. 5	15	2.5	6	5.34	6.7	7.7	7	......
No. 7	12	2.25	......	......	......	......	......	......

There is some apparent regularity in these stadia lengths, but not enough for drawing exact conclusions. Especially is this true of the latter ones because of the many fatalities caused largely by molds, that occurred in an increasing rate. As a result these latter stadia are represented by only a few individuals. In group 1 unfortunately all the larvæ except one were killed by mold early in the second stadium, sharing the fate of groups 2 and 3; but this one survivor lived through its seventh stadium and died in its eighth. Thus of group 7, all the larvæ died before they had completed the second stadium, and of group 4, before they had completed the 6th stadium. Observations terminated in the middle of September. Since work could not be continued during fall and winter, further data of ecdyses and growth and the exact manner of over-wintering, could not be ascertained. An unsuccessful effort was made to determine the winter condition of the larvæ when I resumed work in March.

The first larva found in Spring (1918) was on May 4 at which time just a few new Lemna leaves had come to the surface, (having developed from bulblets, which overwinter at the bottom). Though the food supply was just as meagre May 11, twelve larvæ were secured, and they were becoming increasingly more abundant in the upper water. This represents then the time of resumption of growth and activity. The seventh instar, the last reared the preceding August, was only three-tenths as long as the average full grown larva. Some of the larvæ obtained in May were no larger, but they varied from

2 to 3 mm. in length. The disparity in size is accounted for by earlier or later hatching the previous summer, and because of this fact, and since no individual life history could be traced, no significant comparisons as to size between these larvæ, or with that of the preceding autumn, can be made.

It can be stated that the larvæ have a comparatively slow growth, a large number of ecdyses, that they overwinter at the bottom of the water, and must pass through considerable of their growth in late spring.

Old larvæ were obtained (in 1917) from June 17, when this work was begun, to July 22. The distribution over this period and relative abundance of maximum size old larvæ shows that in this locality the mean date for their full growth is during the first week in July.

Pupa.

The pupa is short-lived. It was not found in nature, but many old larvæ pupated in the laboratory, and, although there was a rather high death rate, due to molds, a number completed their life history. Out of 25 pupæ, the time of pupation of 4 was not secured, and 12 died before emerging as imagoes. The records of the other 9 show an average pupal period of about 3 days.

Adult.

The beetle was first caught on July 4, but only three were then secured. This date corresponds pretty well with that of the first emergence of the beetle in the laboratory, July 6. In nature the beetles became increasingly more abundant up to the latter part of the month, after which there was a rapid decline until the last week in August when no more were captured.

The life stages obviously overlap during early and middle summer, when at some favorable time old larvæ, pupæ, adults, eggs, and even young, new larvæ may exist simultaneously. The period for each life stage is pretty well marked off though with a maximum point of abundance for each.

A summary of the life history (which seems reasonable even from the incomplete results) shows an egg period of about ten days, a larval life of about eleven months, a pupal period of three days, and an imaginal existence of possibly a week or two.

although the last is a mere estimate from a few laboratory cases, and it must be said that the laboratory conditions for the adult were unavoidably very artificial. There is one generation a year.

DESCRIPTION OF STAGES.

The Egg (Fig. 1).

The eggs are ellipsoidal in shape, smooth, of cream-white color, and uniform size, measuring .37 mm. in length and .25 mm. in greatest thickness. Eggs are laid in irregular masses. The embryo in the latter part of the stage is clearly visible.

The Larva, First Instar (Fig. 2).

The first instar is very small, the specimen figured being .69 mm. in length (exclusive of antennæ) and .19 mm. in greatest width. Body elongate, tapering distinctly and continuously caudad, widest at pro- and meso-thorax. Translucent whitish color. Head narrower than thorax, slightly broader than long, widest at eyes. Prothorax longest segment of the body. Eighth abdominal segment longer than others, as long as broad, tapering caudad, and complete (as are preceding seven), but its sternum only half as long as its tergum; ninth segment, represented by sternum only, equal in length to sternum of eighth. Each eye consists of a larger mass of ocelli, with a smaller mass just behind it and nearly confluent with it. Antennæ setaceous, half as long as body, and of 7 segments. Legs similar; coxa short; trochanter triangular; femur and tibia of nearly equal length; tarsus of one segment, and in form of a long single claw. Of the setæ, distributed as shown in Fig. 1, only the very long ones extending posteriorly from the eighth abdominal segment, need be noted here, as a distinguishing character for the instar.

Subsequent Instars.

Succeeding instars do not differ markedly from the first. There is more difference in general appearance between the first and second instars (compare Figs. 2 and 3) than between any two subsequent, successive ones. The long caudal setæ of the first instar are replaced by short setæ after the first molt. Growth in size is very slow. After the second molt the body begins to taper somewhat more cephalad, the greatest width being in the metathorax. A slight yellow-tan color is apparent as early as the third instar; it becomes darker in succeeding ones, and ultimately brown. The two adjacent masses of ocelli soon fuse into one rounded eye. The coxa, even in the second instar is longer than in the first, and in later instars is comparatively much longer.

The most marked change is that of the number and proportionate size of the antennal segments, which increase in a graduated way at successive ecdyses. Examination of available specimens showed a constant number of segments (barring obvious abnormalities) as follows: first instar, 7 segments; second instar, 13 segments; third instar, 21 segments; fourth instar, 29 segments; fifth instar, 35 or 37 segments.

Determination of what stage a larva was in depended upon counts of antennal segments. Lack of sufficient material precluded study of instars directly following the above. Whether there is a similarly graduated increase and constancy for all instars cannot consequently be stated. A continued increase in number (without corresponding large increase in comparative length of the antennæ) seems certain though, for in the full grown larva, a big total of 120 to 125 segments exist. This is a striking feature, and one which does not correspond with the condition in larvæ of Helodes and Cyphon, (11).

Last Instar (Fig. 4).

The average full grown larva has a length of 7 mm. The specimen figured, with a length of 7.33 mm., was of maximum size. The body generally is as described for earlier instars, but is more flattened dorso-ventrally. Its shape can be characterized in short as that of the silver fish, Lepisma sp., a similarity that is true also of the antennæ. Color a dark, uniform brown. Head normally deflexed. Antennæ setaceous, very long and slender, three-fourths as long as body, of 120-125 segments; segments 1 and 2 much longer than any of those following. Leg has long, heavy coxa.

Pupa (Fig. 5).

The pupa is elongate-rounded, about 4.5 mm. in length, and of cream white color. It is attached by its anterior end to the lower surface of a Lemna leaf, and hangs freely. The last larval skin may or may not remain attached to the pupa; if it remains it may be for either a short period or even beyond the emergence of the imago.

Adult (Fig. 6).

The adult (length 3 to 3.5 mm.) was originally described by Guerin (4). Although his work was not available, the descriptions of Horn (5), and Blatchley (1), obviate the need of technical description here. The most characteristic features which are easily noted in this beetle are its very broadly oval shape, its short, much deflexed head, and its greatly swollen hind femora.

Although the color of very many of the specimens of beetles is, as described, "uniform piceous or nearly black, moderately shining," (1), of a considerable number of others it is a uniform dull, dark brown. The beetle is "sparsely pubescent," but the brown ones are relatively more pubescent than the black. The brown ones as a group are also larger, having all about the maximum length of 3.5 mm., while the black are on the whole 3 mm. in length. While Horn (5), says that the claw on the tarsus is simple, in all beetles examined in this study, the tarsal claw was double.

ACKNOWLEDGMENT.

The writer wishes to express his indebtedness to Professor Wm. S. Marshall, who gave aid and suggestions throughout the progress of the work.

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EXPLANATION OF PLATE XXXV.

(Figures outlined with camera lucida).

Fig. 1. Egg, length .37 mm.

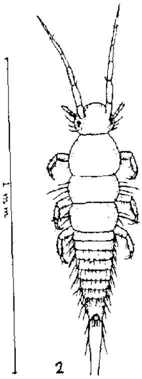
Fig. 2. Larva, first instar, dorsal view, length .69 mm.

Fig. 3. Larva, second instar, dorsal view, length .74 mm.

Fig. 4. Larva, final instar, dorsal view, length 7.33 mm.

Fig. 5. Pupa (P), attached to Lemna leaf. Last larval skin (L) still attached to pupa. Leaf tilted upward to show under surface completely.

Fig. 6. Adult beetle, dorsal view, length 3.6 mm. Head much deflexed so that it is not seen from this aspect. Pubescence indicated by short hair lines.



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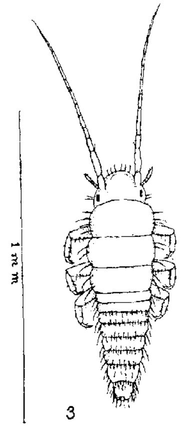

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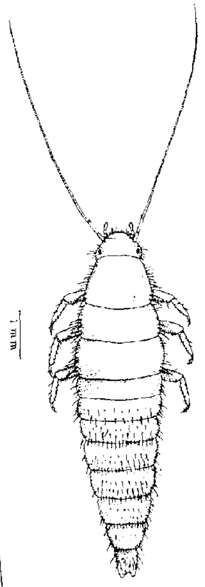

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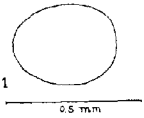

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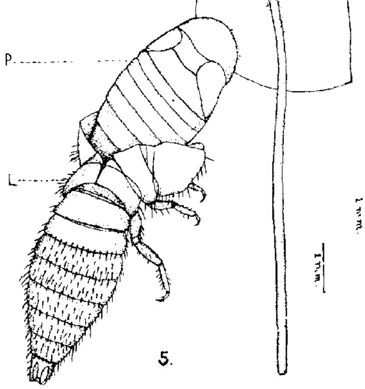

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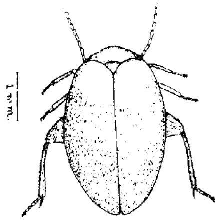

6

alter C. Kraatz

PUPÆ OF COMMON SPHINGIDÆ OF EASTERN NORTH AMERICA.*

By Edna Mosher.

Since beginning the study of pupæ it has been necessary many times to try to prove that a classification based on pupal characters should indicate natural relationships just as well as a study of the adults. There are still too few persons who believe that anything can be gained from a study of the biology of a species, or that a classification based on the immature stages of a group offers any aid in the solution of problems relating to the adults. It seemed to me, therefore, that a study of so compact a group as the Sphingidæ, upon which such a careful study of the adults of the world species has been made by Rothschild and Jordan in their masterly revision of the family, would offer some evidence on this vexed question. The study has confirmed in practically every detail the classification of Rothschild and Jordan. It has shown the same relationships, and practically the same degree of relationship existing between the various species. In some cases it was not possible to separate satisfactorily very closely related genera and species, which serves to illustrate another idea about pupæ which seems to me to be an absolute fact, namely, that the pupa is slower to change than either larva or adult and therefore indicates the ancestry and relationships of a species or genus better than any of the other stages.

Since the Sphingidæ contain the largest, as well as some of the most interesting lepidopterous pupæ, it also seemed worth while to make it possible for any one to identify the commoner forms. It has not been possible to rear all of the species to verify identifications, but practically all of the material not reared by the author was reared by Mr. William Beutenmueller, a well-known authority on the subject.

Except where especially mentioned the materials used in this study are in the collection of the University of Illinois or in the author's private collection.

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* Contributions from the Entomological Laboratories of the University of Illinois, No. 58.

CHARACTERISTICS OF THE PUPÆ.

The pupæ belonging to this family are, in the main, very easy to distinguish from other lepidopterous pupæ. They are seldom found in cocoons, and these, when present, are formed of a few threads, or at most a thin layer of silk which fastens together a few leaves or twigs found on the surface of the ground. The cocoons are never suspended from twigs as in the case of many saturnian pupæ, but are always found free. The majority of the sphinx moths, however, spend their pupal life in a cell in the ground, which is formed by the mature larva. When ready to pupate the larvæ burrow into the soil to the depth of a few inches and push the soil on all sides with their heads until the space is large enough to turn in, and then the change from larva to pupa takes place.

Sphingid pupæ are usually of considerable size, only one or two species measuring less than an inch in length. The majority average one and one-half inches in length, although some are much longer. As a general rule the body is somewhat fusiform, being narrowed at the cephalic end with the mesothorax considerably wider. The remainder have the ordinary type of pupa found in the noctuids and many others. The fifth and sixth abdominal segments are "free" or movable as in the saturnians.

The body surface is generally punctate, with indeterminate transverse striations between the punctures, and the sides of the abdomen in the spiracular region are usually more strongly sculptured than the rest of the body. The cephalic margins of abdominal segments 5-7 are strongly furrowed or carinate in most sphingid pupæ. These furrows are cephalad of the spiracles and usually extend for a considerable distance dorsad. The furrows are so deep in some instances as to form a sort of pocket-like cavity. They have been referred to as spiracular furrows.

So far as observed no setæ have been found on the body. In those species in which the caudal horn is present in the larva, the scar may usually be easily identified on the dorsum of the eighth abdominal segment. The scars of the larval prolegs are also easily distinguished on the ventral surface of the fifth and sixth abdominal segments, but the scars of the anal prolegs are usually indistinct. The cremaster is usually triangular, sharply pointed at the distal end and in many instances slightly bifurcate. It never bears hooks or spines, excepting in the genus Hæmorrhagia where the larvæ spin cocoons. Then a few slender hooks along the lateral margin and at the distal end of the cremaster hold the pupa in position in its cocoon.

The metathorax often bears some distinguishing character, such as prominent furrows, or roughened areas of various shapes, which seem to be characteristic in the different groups. The antennæ are slender and pointed at the distal end, the length usually at least ten times the breadth. In the subfamily Ambulicinæ the antennæ are considerably broader and differ markedly in the sexes, approaching somewhat the condition found in the Saturniidæ. They generally bear rows of minute tubercles arranged in various ways. The suture between the antenna and the epicranial area is always clearly defined. Owing to the fact that the antennæ are so slender, both eye-pieces are always to be clearly distinguished. The glazed eye-piece does not always form a smooth band around the entire mesal margin of the sculptured eye-piece, but on the contrary, in many species forms an arc or crescent-shaped piece which reaches neither the antennæ nor the caudal margin of the head. The invaginations for the anterior arms of the tentorium are hard to determine.

The maxillæ reach the greatest development in the Lepidoptera in certain of the species of this family. Here the length of the maxillæ in the pupæ often greatly exceeds the length of the wings, in some instances being twice their length. This elongation of the maxillary tube is used by the adults in reaching the nectaries at the bottom of long tubular flowers. In most lepidopterous forms in which the maxillæ are longer than the wings of the pupa, the remainder can not be soldered down to the body surface on account of the movable abdominal segments, so this part usually extends free along the meson of the ventral surface of the body. In a number of species the maxillæ extend for some distance beyond the caudal end of the body. This would probably result in serious injury to the sphingid pupa, as all of the forms in which the maxillæ are longer than the wings pupate in the soil. The Sphingidæ have provided for the extra length of the maxillæ in three different ways, and as far as my knowledge goes, two of these are peculiar to the pupæ of this family. In some of the genera, as Deidamia

(Fig. 8), or Darapsa the maxillæ are too long to occupy the space between the labrum and the caudal margin of the wings if they extended straight caudad, so the proximal part of the maxillæ arches away from the body and forms a prominent curve near the cephalic end. In other genera as Pholus, (Fig. 7), Celerio, Xylophanes, etc., the head has been tipped back so the labrum appears on the dorsal surface. This gives some additional length, and, as the wings extend about three-fifths the length of the body, and the segments are lengthened ventrally to accommodate these, it usually is sufficient for the length of the maxilla. In cases where it is not, the proximal part arches out from the surface of the body as previously described. This is true of *Xylophanes tersa.* There are still some pupæ, however, with considerably longer maxillæ, and the method of taking care of this extra length seems to me to have developed from those previously described. It would be rather difficult for the maxillæ to be arched very far from the surface, so the extra length is taken up in a loop at the proximal end. This loop is, in most instances, closely appressed to the ventral surface of the body. In others, as in the common tomato worm pupa (Fig. 3), it is strongly arched, while in *Herse cingulata* the loop is equal in length to the remainder and is recurved (Fig. 2). When one considers that the maxilla is double in the maxillary loop (Fig. 1) it will be seen that in such genera as Herse, the maxillæ must be at least one and one-half times the length of the body. The maxillary loop has been referred to by some authors as the raised tongue case, or the jug-handle tongue case, as contrasted to the ordinary type of maxilla (Fig. 5) which was said to be "sunken." Other authors referred to it simply as the tongue case, ignoring the remainder of the maxillæ. In all measurements involving the maxillæ, or the length of wings when comparison is made, the length is always measured from the suture separating the labrum and maxillæ.

CLASSIFICATION.

Strange as it may seem, the spiracular furrows and the maxillæ have proven to be the best characters for separating the pupæ into the various divisions of Rothschild and Jordan. In their "Revision of the Lepidopterous Family Sphingidæ" in 1903 they divide the family into two groups, the *Asemanaphoræ* and the *Semanaphoræ*. These groups may be distinguished in the pupæ by a very easy character—the presence of spiracular furrows on three abdominal segments, that is 5–7, in the former; and the absence of the furrows from one, two, or all of the segments in the latter. These divisions are further subdivided into subfamilies, and of these we have representatives of five, the Acherontiinæ and Ambulicinæ belonging to the *Asemanaphoræ;* the Sesiinæ, Philampelinæ, and Chærocampinæ belonging to the *Semanaphoræ*. It was found possible to separate the first two subfamilies and the last by well-defined characters; the Sesiinæ and Philampelinæ were more difficult. All of our genera of Sesiinæ except Pseudosphinx seem to fall into a natural group but any character which could be used to separate it from the Philampelinæ is shared by Pholus, and in a less degree by Proserpinus, of that subfamily. The remaining genera of Philampelinæ form a very compact group. Rothschild and Jordan found the same condition in their study of the adults. On page 349 we find "Of all these issues from the ancestral *Semanaphoræ* only one group of genera is sharply circumscribed; it claims the rank of a subfamily. This group, * * * is termed by us the Chærocampinæ. The remaining groups of *Semanaphoræ* are not so obviously distinguished from one another in all their members, owing to the preservation of generalized forms linking the groups together, and to the differences becoming obscured by the recurrence of similar structures in phylogenetically widely different genera." Owing to this difficulty it seems best not to attempt keys to the subfamilies, but to furnish a key to the genera of the family and then discuss the genera under the different subfamilies of Rothschild and Jordan. The synonymy follows, in the main, Barnes and McDunnough's Check List which differs slightly from that of Rothschild and Jordan, but is more easily accessible for American students. Some slight changes have been made necessary where it was impossible to separate, or to connect, genera and species in this study.

KEY TO THE GENERA OF SPHINGIDAE.

a. Spiracular furrows present on three segments, that is, on abdominal segments 5-7...(*Asemanaphoræ*)

b. Abdominal segments 5-7 with either one or two (occasionally a trace of three) spiracular furrows, always with one deep pocket-like furrow (Fig. 2) and a shallower outer one; body always without spines and with a triangular cremaster......................................(*Acherontiinæ*)

c. Maxillary loop present.

d. Maxillary loop with its distal half recurved and touching the proximal portion (Fig. 2).......................................*Herse* Oken.

dd. Maxillary loop with its distal half never recurved, its distal end touching the body.

e. Maxillary loop strongly arched from the surface of the body, the height of the arch always greater than the width of the loop in that region.

f. Dorsum of abdominal segments 2-8 with a strongly rugose band on the cephalic third, similar to the triangular area on each side of the metathorax..............................*Cocytius* Hbn.

ff. Dorsum of abdominal segments 2-8 punctate; metathorax with a strongly elevated smooth transverse ridge on each side. *Protoparce* Burm.

ee. Maxillary loop never strongly arched from the surface of the body, the space between it and the surface never as great as the width of the loop, usually closely applied to the ventral surface.

f. Two spiracular furrows present (Fig. 3).

g. Spiracular furrows 5 mm. or more in transverse length, and extending ventrad of the spiracle for a distance equal to the length of the spiracle; maxillary loop never over 5 mm. in length. *Chlænogramma* Sm.

gg. Spiracular furrows always less than 5 mm. in transverse length, seldom extending ventrad of the spiracle, if so, then for a distance less than the length of the spiracle; maxillary loop in most species over 5 mm. in length................*Sphinx* L.

ff. One spiracular furrow present—the deep inner one.

g. Maxillary loop extending as far caudad as the distal ends of the prothoracic legs, and occasionally beyond them...*Atreus* Grt.

gg. Maxillary loop never extending as far caudad as the distal ends of the prothoracic legs...........................*Dolba* Wlk.

cc. No maxillary loop present.

d. With two spiracular furrows.........................*Ceratomia* Harr.

dd. With one spiracular furrow, the deep inner one.

e. Maxillæ never more than five-sevenths the length of the wings; body surface polished, the punctures on the abdomen distinct. *Daremma* Grt.

ee. Maxillæ normally more than five-sevenths the length of the wings; body surface dull, the punctures on the abdomen usually obscured by the sculpturing.................................*Lapara* Wlk.

bb. Abdominal segments 5-7 either with three or four more or less interrupted furrows over each spiracle, the surface of the furrows often punctate like the remainder of the cephalic margin (Fig. 5) or with one deep furrow, in which case the body is spinose and the cremaster truncate. (*Ambulicinæ*)

c. Surface of body spinose; cremaster broad and truncate; one spiracular furrow present...................................*Cressonia* G. & R.

cc. Surface of body smooth; cremaster triangular and pointed; more than one spiracular furrow present.

d. Maxillæ never half the length of the wings, their length 5-7 mm.; length of pupa usually less than 40 mm., usually slender...*Smerinthus* Latr.

dd. Maxillæ half the length of the wings, their average length 10 mm., sometimes longer; length of pupa normally over 45 mm., very stout. *Pachysphinx* R. & J.

aa. Spiracular furrows usually present on one or two segments, never on three, often absent.. (*Semanaphoræ*)

b. Spiracular furrows present.

c. Spiracular furrows usually three or four, separated by carinate ridges, which are never broken and wavy as in Fig. 9, and present on the fifth or on the fifth and sixth abdominal segments.......... (*Sesiinæ* in part)

d. Cremaster sparsely covered with short curved spines on the dorsal and lateral aspects; spiracular furrows present on segments 5 and 6. *Hæmorrhagia* Grt.

dd. Cremaster never spinose; spiracular furrows only present on segment 5. *Erinnyis* Hbn.

cc. Spiracular furrows usually five or six, separated by interrupted, wavy, carinate ridges (Fig. 9) usually present only on the fifth segment, but sometimes on the sixth.............................. (*Chærocampinæ*)

d. A small portion of the prothoracic femur always exposed; color light brown or coffee color, never with a prominent median dorsal stripe. *Celerio* Oken.

dd. Prothoracic femur never exposed; color grayish or grayish brown with a prominent median dorsal stripe... ....*Xylophanes* Hbn.

bb. Spiracular furrows never present.... (*Sesiinæ* in part; *Philampelinæ* in part)

c. Body always more than two inches long, labrum either at the cephalic end or on the dorsal surface of the body.

d. No mandibular tubercles present; body surface highly polished with only a few small punctures; color black, usually marked with red. *Pseudosphinx* Burm.

dd. Mandibular tubercles present; body surface roughened and rather coarsely punctate; color uniform dark brown..........*Pholus* Hbn.

cc. Body always much less than two inches long; labrum usually on the ventral surface, sometimes at the cephalic end of the body.

d. Body with three prominent projections at the cephalic end, consisting of a very rugose tubercle on the labrum and one mesad of each glazed eye-piece; proximal part of maxillæ excurved and carinate. *Deidamia* Clem.

dd. Body without three prominent projections at the cephalic end, the only prominent tubercles are mandibular.

e. Abdominal segments 5-7 with one or more interrupted rows of spines along the cephalic margin, more prominent on the dorsal surface. *Darapsa* Wlk.

ee. Abdominal segments without spines.

f. Mandibular area usually with distinct tubercles, if not distinct, then the appendages roughened with deep sculpturing.

g. Body surface rough, deeply punctate over the entire surface of the abdominal segments, especially segments 8-10; prothoracic femur never visible............................*Amphion* Hbn.

gg. Body surface smooth and polished, the cephalic portion of the segment with punctures of medium size, the caudal portion finely, sparsely punctate; prothoracic femur always visible. *Proserpinus* Hbn.

ff. Mandibular area without distinct tubercles; surface of appendages not very rough, usually silky or polished in appearance.

g. Dorsum of eighth abdominal segment with a row of large deep punctures or pits along the cephalic margin; color always light brown with darker markings...............*Ampelæca* R. & J.

gg. Dorsum of eighth abdominal segment never with a row of deep punctures or pits along the cephalic margin; color uniform dark brown..................................*Sphecodina* Blanch.

Subfamily ACHERONTIINÆ.

This subfamily consists of pupæ which have either one or two spiracular furrows on each of the abdominal segments 5-7. This is the only subfamily in which the maxillary loop is found although all members of the subfamily do not possess it. The length of maxillæ varies greatly, being longest in the genus Herse and shortest in Ceratomia. The glazed eye-piece is usually almost hemispherical, bounded along its mesal margin by a smooth impressed line, which usually touches neither the antenna nor the maxilla. The antennæ are filiform, of the same width throughout, except at the pointed tip. Rothschild and Jordan have divided this subfamily into two tribes, the first of which, Acherontiicæ, has only one American representative, Herse, while all the other genera belong to the Sphingicæ. It will be seen from a study of the pupa that Herse differs considerably from the other genera. The remaining genera form a remarkably compact group excepting Ceratomia, Daremma, and Lapara, which, however, show very close relationships. They differ principally in the absence of the maxillary loop.

Genus **Herse** Oken.

The species of this genus are characterized by having the maxillary loop doubled back upon itself as shown in Fig. 2. The body is broader at the cephalic end than is customary in this family and the head is bent slightly ventrad, but not so that the labrum is visible. The maxillary loop extends about half way to the distal end of the maxillæ. The prothoracic femur has always a considerable portion exposed. There are always two prominent spiracular furrows on the movable abdominal segments, a deep, pocket-like, mesal one and a longer, shallower, lateral one, with a slight ridge and furrow often visible between the two. The first eight abdominal segments are thickly punctate on the cephalic half. The cremaster is triangular, with the length and breadth about equal; sometimes slightly bifurcate.

But one species of this genus is found in North America. This is a tropical or subtropical species occurring rarely in the temperate regions along the Atlantic coast. The moths sometimes stray as far north as Canada.

Herse cingulata Fabr. (Fig. 2).

Color chestnut brown; body surface smooth and polished, excepting the ninth abdominal segment and the cephalic half of the first eight which are densely punctate; head nearly as broad as long; antennæ transversely striated, a few tubercles along the margin and the elevated flagellum, not extending as far as the prothoracic leg in the female; labrum only visible on the cephalic aspect of the head; mandibular tubercles smooth, scarcely elevated; prothoracic legs with a prominent swelling opposite the exposed portion of the femur; mesothoracic wings extending about three-fifths the length of the body; mesothoracic spiracle with an elevated, black caudal margin which almost conceals the opening; mesothorax prominently excurved along the lateral margin; metathorax with a very rugose triangular, or somewhat cordate area on each side the meson; scar of caudal horn a distinct, slightly depressed smooth area, a longitudinal furrow on the meson and a small tubercle on each side; cremaster deeply rugose. Length 52-62 mm., greatest width 16–18 mm.; length of cremaster 2.5 mm.

Genus **Cocytius** Hbn.

One species of this genus, *C. antæus*, ranges as far north as Florida and occasionally farther. The pupa is the largest which has ever been examined by the writer and differs from all others examined in having a prominent rugose band on the dorso-cephalic portion of the first eight abdominal segments, which is like the rugose areas on the metathorax. These areas on the metathorax are almost identical in shape and sculpturing with those of *Herse cingulata*. Similar sculpturing occurs on the ridge caudad of the mesothoracic spiracle. The maxillary loop is strongly arched from the surface of the body, almost forming a semi-circle, and its distal end is swollen into a prominent bulb. Rothschild and Jordan describe one species of this genus as having a prominently recurved loop of "two and one-half windings." This seems rather peculiar as this loop appears to have generic value in all other cases. In *C. antæus* the lateral margins of the loop are closely set with tubercles, seemingly formed by the transverse constrictions over its surface. According to Rothschild and Jordan the other known species with a similar loop has these prominent markings. The body is fusiform, the labrum visible from the dorsal surface.

Cocytius antæus Dru.

Color chesntut to mahogany brown, with the sculptured areas on the dorsum much darker, and occasional blotches and lines of a darker color; surface smooth and highly polished, except for the bands of sculpturing; maxillary loop extends nearly half the distance to the caudal margin of the wings and touches only at the prominent bulbous tip, prominently arched—the height of the arch about 10 mm.; antennæ extend slightly farther caudad than the prothoracic legs; portion of prothoracic femur exposed, 6-7 mm. long, 1.5 mm. wide; prothoracic leg usually with a prominent elevation on the tibia; inner spiracular furrow about 2 mm. from the outer which is bounded by two carinate ridges making it appear to be three furrows on some of the segments; rugose band of the eighth segment interrupted by the scar of the caudal horn which is smooth and polished; cremaster very rugose, about 4 mm. long, ending in a sharp point. Length of pupa described, 101 mm., greatest width 20 mm.

Genus **Protoparce** Burm.

The species of this genus are the only common pupæ belonging to the so-called "jug-handled" type, thought by many persons to be typical for the family Sphingidæ. The maxillary loop is strongly arched from the surface of the body, usually touching only at the tip, and extending about half the length of the wings. Some of the species of Sphinx occasionally have the maxillary loop arched considerably, and when this happens *S. chersis* and *P. sexta* look very much alike. The body is fusiform with the cephalic end rather blunt. The prothoracic femur always has a narrow portion exposed. The movable abdominal segments have two spiracular furrows, a deep pocket-like mesal one and an outer less prominent lateral one.

These pupæ are found in earthen cells in the ground where they winter in the pupal stage. There are two species of this genus found in the temperate zone, *P. quinquemaculatus* and *P. sexta*. The pupæ of these two species vary greatly with regard to the most obvious characters, such as length of maxillary loop, legs, antennæ, etc. The maxillary loop, in the great majority of individuals of *P. quinquemaculatus* is longer and far more strongly arched than in *P. sexta*, but it is not a character which can be used in separating the species, as it varies markedly with the individuals. Such a character was not found until over a hundred specimens had been bred and examined. Then it was discovered that the spiracular furrows provided a constant character. The species, therefore, may be separated as follows:

a. Spiracular furrows of the fifth abdominal segment always extending ventrad of the spiracle for at least 3 mm.; maxillary loop usually reaching about three-fourths of the distance between the cephalic end of the body and the caudal margin of the wings, strongly arched from the surface, (generally about 5 mm.) and touching only at the tip............*P. quinquemaculatus*

aa. Spiracular furrows of the fifth abdominal segment very seldom extending ventrad of the spiracle and then only the lateral furrow, which may extend for about 1 mm. or less; maxillary loop usually reaching for half, or less, the distance between the cephalic end of the body and the caudal margin of the wings, not strongly arched (seldom over 2 mm.), and touching more than at the tip...*P. sexta*

Protoparce sexta Johan. (Fig. 3).

Color chestnut brown; head, thorax and appendages with very shallow impressed lines, appearing smooth and polished on most of the surface, abdomen punctate, the annulets fairly distinct on all segments; metathorax with a prominent rounded ridge on each side the meson, usually darker than the remainder of the segment; maxillary loop averages 17 mm. in length and extends about half the distance to the caudal margin of the wings; antennæ extend considerably beyond the distal ends of the prothoracic legs, sometimes almost to the mesothoracic pair; spiracular furrows seldom extending ventrad of the spiracles; scar of caudal horn usually elevated and smooth; cremaster 1.5–2.5 mm. long, bifurcate at tip. Length of pupa 45–60 mm., greatest breadth 10–12 mm.

Protoparce quinquemaculatus Haw.

This species differs from the preceding only in the characters given in the key.

Genus **Chlænogramma** Sm.

A single species of this genus is found in eastern North America. It is characterized by the very short maxillary loop, which averages 3 mm., and by two very long spiracular furrows. The body is typically sphingiform, with the labrum visible on the ventral surface. The maxillary loop extends for about one-sixth the length of the maxilla, and is closely applied to its surface. A distinct swelling is always visible on each prothoracic tibia and a small portion of the femur is always exposed. The spiracular furrows are about equal in transverse length, or the inner one is longer. The body is quite strongly sculptured on the head and thorax and less strongly on the appendages, while the abdomen is distinctly punctate with traces of annulets on the dorsal surface. The cremaster is triangular, somewhat longer than broad, deeply rugose and occasionally bifid at tip. The only species is apparently not common and very little has been published regarding its life history.

Chlænogramma jasminearum Bdv.

Color chestnut brown; labrum with an indistinct tubercle in each ventral angle; mandibular area slightly elevated and very rugose; maxillary loop deeply transversely striate, slightly bulbous at distal end, never over 5 mm. in length, usually less; antennæ transversely striate with indications of tubercles along the lateral margins, extending farther caudad than the prothoracic legs; mesothoracic spiracles with slightly elevated black margins; abdominal segments usually showing four indistinct dorsal annulets; scar of caudal horn very small, usually smooth, on an elevated transverse ridge in the middle of the segment; cremaster about 3 mm. long, or less, strongly rugose and usually almost black; length of pupa, 45–48 mm., greatest width 10 mm.

Genus **Dolba** Wlk.

This monotypic genus is also very closely related to Protoparce, but more so to Atreus. In each of these genera there is only one spiracular furrow present, a very distinct, deep pocket-like furrow. The body is typically sphingiform, with the labrum mostly on the cephalic aspect of the head. There is a distinct ridge along each lateral margin of the clypeus and labrum, which shows as two small projections at the caudal end in both dorsal and ventral views. This ridge sometimes breaks up into tubercles. The maxillary loop varies considerably in length, from 4 mm. in small specimens, to 8 mm. in the large ones, but is always less than half the length of the maxillæ. The impressed line along the mesal margin of the glazed eye-piece touches the antenna in this genus. The antennæ are slightly elevated, transversely striate, with two rows of tiny tubercles extending for the entire length. The tibia of the prothoracic leg is slightly swollen, but the femur is not exposed. The cremaster is triangular, ending in a smooth cylindrical point, which may be slightly bifurcate at tip.

The species of this genus *Dolba hylæus* is only found in eastern North America so far as known. The larvæ are fairly common on pawpaw in the region around Urbana, Ill., and probably wherever its food plants occur.

Dolba hylæus Dru.

Color yellowish to chestnut brown; head, thorax and appendages with indeterminate wavy striations; abdomen with shallow indistinct punctures on the first seven segments, the remainder distinctly punctate, the dorsal surface showing about three annulets on each segment; maxillary loop deeply transversely striate, the end very slightly bulbous and usually closely applied to the surface, but occasionally slightly elevated at the proximal end, the length between one-third and one-half of the maxillæ; antennæ extending about midway between the proximal ends of the first two pairs of legs; mesothoracic spiracles with black elevated margins; spiracular furrows as in Fig. 4; scar of caudal horn normally prominent, elevated, usually smoother and darker than the remainder of the segment; cremaster 2 to 2.5 mm. long, rugose, with a smooth spine at the end. Length of pupa 29–37 mm., greatest width 7–8 mm.

Genus **Ceratomia** Harr.

This is one of the genera in which a study of the pupæ does not support the classification based on either the larvæ or adults. The larvæ of the three species usually placed in this genus differ remarkably from each other. The adults have very much in common and, if separated, Rothschild and Jordan remark that it would necessitate a genus for each species. The pupæ of two of these species, which fall in the same division of the key by Rothschild and Jordan, are remarkably alike, while the third species differs markedly in the spiracular furrows. Since these furrows have proved such valuable aids in the classification, the species have been separated on this basis—*amyntor* and *undulosa* remaining in the genus Ceratomia, *catalpæ* being placed under the genus Daremma. These are the only two genera known in this region with bodies of normal shape, having a deep spiracular furrow on each of the movable segments and without a maxillary loop. The body is typically sphingiform with the labrum visible in ventral view. The color is chestnut brown. The maxillæ are slightly swollen at the proximal end, and extend at least two-thirds of the distance to the caudal margin of the wings. The tibia of the prothoracic leg is slightly swollen and the femur is not exposed. The antennæ are indistinctly transversely striate and slightly roughened by minute tubercles which are more numerous at the proximal end. The abdominal segments are punctate, and often show distinct annulets. There are two spiracular furrows present, the inner one much deeper. The cremaster is somewhat triangular, longer than broad and sometimes ends in a sharp spine, although it is usually slightly bifurcate.

The two species of this genus resemble each other very closely in size and general appearance. They may be separated as follows:

a. Maxillæ normally reaching the caudal margin of the wings, occasionally overlaid by the wings at the distal end; mesothorax with the scar of a larval horn on each side of the meson near the middle of the segment....*C. amyntor*
aa. Maxillæ never reaching the caudal margin of the wings, usually two-thirds of their length; mesothorax never with scars of larval horns...*C. undulosa*

Ceratomia undulosa Wlk.

Appendages mostly transversely striate; all except the wings appearing polished; head and thorax with coarser, irregular sculpturing, appearing dull; abdominal segments thickly, usually finely punctate, the punctures confluent on the first seven segments, larger and distinct on the remainder; annulets showing plainly in some individuals, but scarcely visible in others; maxillæ slightly swollen and deeply striate at the proximal end, extending for about two-thirds the length of the wings; spiracular furrows equal in length; scar of caudal horn smooth, usually elevated, often with a few radiating lines; cremaster 2.5 mm. in length, very rugose, narrowing to a bifid spine at tip. Length of pupa 45-52 mm.; greatest width 13 mm.

This species is more variable than *amyntor*. Although the abdomen is usually finely punctate, certain individuals show very coarse punctures like *amyntor*. As far as my experience goes the scars on the mesothorax may be relied on to separate the two species, if no other characters were available.

Ceratomia amyntor Hbn.

Body usually dull; the head and thorax with rather deep indeterminate striations and finer striations on the appendages which sometimes appear polished; abdomen with medium or coarse punctures on the first seven segments, these sometimes confluent and interrupted by transverse striations, the remaining segments always coarsely punctate, annulets usually distinct on the dorsum of the segments; maxillæ slightly swollen and striate at proximal end, sometimes for the whole length, and reaching the caudal margin of the wings, though sometimes partially overlaid by the wings at the distal end; mesothorax with a scar of a larval horn prominent on each side the meson about two-fifths of the distance from the cephalic to the caudal margin, each represented by a more or less interrupted series of concentric circles, another pair of scars usually visible near the cephalic margin and a little farther apart than the former, usually elevated; metathorax with a slightly elevated crescentic ridge on each side the meson only distinct in fresh specimens; scar of caudal horn very seldom elevated, smooth and polished; cremaster 3 mm. long, very rugose and slightly bifid at tip. Length of pupa 45-50 mm., greatest width 13 mm.

Genus **Daremma** Grt.

The pupæ of this genus are normally very much smaller and more slender than those of Ceratomia and the entire surface appears polished. The segments are not so deeply punctate and the punctures are smaller and less numerous on the caudal half. There are few, if any, of the transverse striations which were present in the species of Ceratomia. There is no maxillary loop and the maxillæ do not reach the caudal margin of the wings. The antennæ are indistinctly transversely striate and have a single row of minute tubercles along the middle line. The prothoracic legs usually show slight swellings and occasionally a very narrow portion of the femur is exposed on one side. There is but one deep spiracular furrow present, the outer shallow one present in Ceratomia is lacking here. The cremaster is triangular, narrowed to the tip, which is sometimes slightly bifurcate.

This genus, as defined here, consists of a single species, *D. catalpæ*, the catalpa sphinx, which is a common pest wherever these trees are found. The larvæ enter the soil to pupate.

Daremma catalpæ Grt. (Fig. 4).

Color yellowish to chestnut brown; head and thorax with fine indeterminate transverse striations, these practically absent from the abdomen which shows fine scattered punctures on the first seven segments, more numerous on the cephalic half and on the remaining segments; annulets usually distinct on the first three abdominal segments; each abdominal segment usually shows some fine longitudinal furrows on the dorso-meson at the cephalic margin; maxillæ five-sevenths of the length of the wings, ending just beyond the mesothoracic legs; proleg scars very prominent on the venter, usually depressed rounded areas; metathorax with a slightly curved transverse furrow in the middle of the segment on each side of the slightly elevated median line; scar of caudal horn slightly elevated and punctate like the remainder of the segment, usually having a prominent depressed area just caudad of the elevation; cremaster about 2 mm. long, finely rugose, usually bluntly pointed at tip, sometimes bifurcate. Length 30-35 mm.; greatest width 8-9 mm.

This species seems to be fairly constant in its characters and not so variable as either of the species of Ceratomia.

Genus **Atreus** Grt.

This genus is said by Rothschild and Jordan to be "an offshoot from Protoparce, or rather from a form (not yet discovered, or extinct) connecting Protoparce with Hyloicus (Sphinx)." A study of the pupa shows it to be indeed closely connected with the two genera above mentioned. It is separated from Protoparce by the flat maxillary loop, which never arches from the surface of the body, and from Sphinx by the presence of a single spiracular furrow. The characters separating it from Sphinx are practically the same as those separating Daremma from Ceratomia. The body is typically sphingiform with the labrum at the cephalic end. The labrum is very rugose and has a row of four small tubercles adjacent to the maxillæ, the two mesal ones being more prominent and easily visible at the end of the body in cephalic and lateral views. The maxillary loop is closely appressed to the ventral surface of the body, and reaches slightly more than half way to the caudal margin of the wings. The movable segments have one deep pocket-like spiracular furrow. The cremaster is somewhat triangular, longer than broad and ends in a sharp point.

The genus includes a single species, *A. plebeja*.

Atreus plebeja Fabr.

Color chestnut brown, often marked with black or darker brown blotches in various places; body surface polished except the head, prothorax and parts of the mesothorax which are irregularly sculptured; abdominal segments finely, but rather sparsely punctate excepting along the cephalic portions of the segments; median pair of tubercles on labrum longer than broad, rounded at the tip, the lateral ones shorter and somewhat pointed; maxillary loop about 12 mm. long, not extending as far caudad as the antennæ of either sex, usually as far as the prothoracic legs; scar of caudal horn very distinct, smooth and polished, usually with shallow radiating furrows; cremaster with the proximal half rugose, the remainder smooth and polished, its length about 2.5 mm., ending in a pointed tip, with occasional indications of bifurcation. Length of pupa 40–45 mm.; greatest width 10 mm.

Genus **Sphinx** L.

This genus is very closely related to Protoparce, the main difference in the pupæ being in the maxillary loop, which is never strongly arched in Sphinx, but closely applied to the ventral surface of the body in most species, or slightly elevated in others. The body is typically sphingiform, with the labrum at the cephalic end of the body and partially visible in ventral view. The antennæ have the surface more or less roughened with minute rounded tubercles, and are transversely ridged, to correspond with the segmentation of the adult. There is a noticeable difference in the length of antennæ in most species. Nearly all of the species show annulets on the dorsum, although only on the cephalic segments in some species. The movable segments have two spiracular furrows, the inner one deep and pocket-like, the outer shallow, both with carinate edges, less than 5 mm. long, and never extending ventrad of the spiracle. The scar of the caudal horn is always present, usually easily distinguished by a smooth area, while the remaining surface of the segment is punctate. Many species have a prominent depression just caudad of the scar. The cremaster is always triangular, longer than broad and bifurcate at the tip in most species. According to Rothschild and Jordan this genus includes thirty species and twenty of these occur in North America. Some of these species are confined to the region west of the Mississippi. Of the eastern species, it has only been possible to obtain pupæ of six. Three of these I have reared many times: *S. chersis*, *S. kalmiæ*, and *S. drupiferarum*. Of the other species live pupæ were purchased and one or two allowed to emerge.

Two other species were reared to the pupal stage but adults were not obtained. These may be *S. ligustri* and *S. canadensis*, but it seems better not to describe them at this time from a single pupa, without being sure of the identification.

The six common species described here may be separated as follows:

a. Maxillary loop less than 6 mm. long and extending one-fourth or less the distance to the caudal margin of the wings; surface of antennæ roughened with four or five rows of minute tubercles.

  b. Maxillary loop 3-4 mm. long, averaging 3 mm., extending less than one-fourth, usually one-fifth, the distance to the caudal margin of the wings. *S. luscitiosa*

  bb. Maxillary loop 5-6 mm. long, averaging 5 mm., extending one-fourth (or perhaps slightly more) of the distance to the caudal margin of the wings. *S. gordius*

aa. Maxillary loop always more than 6 mm. long and extending for more than one-fourth the distance to the caudal margin of the wings; surface of antennæ with less than four distinct rows of tubercles.

  b. Maxillary loop closely applied to the ventral surface of the body; large, stout pupæ normally over 45 mm. long.

    c. Transverse carinate ridge of metathorax prominent, extending at least half way across the segment; maxillary loop 13-15 mm. long, usually extending half the distance to the caudal margin of the wings; antennæ extending at least half way between the tips of the prothoracic and mesothoracic legs.......................................*S. chersis*

    cc. Transverse carinate ridge of metathorax inconspicuous, extending less than half way across the segment; maxillary loop 9-11 mm. long, usually extending two-fifths of the distance to the caudal margin of the wings; antennæ seldom extending beyond the tips of the prothoracic legs. *S. drupiferarum*

  bb. Maxillary loop touching the surface of the body only at the bulbous tip; smaller, slenderer pupæ, generally less than 40 mm. long.

    c. Maxillary loop 7.5-8 mm. long, extending about one-third of the distance to the caudal margin of the wings; antennæ extending to, or slightly beyond, the tips of the prothoracic legs....................*S. kalmiæ*

    cc. Maxillary loop 9.5-10 mm. long, extending nearly half the distance to the caudal margin of the wings; antennæ extending at least half-way between the tips of the prothoracic and mesothoracic legs..........*S. eremitus*

Sphinx luscitiosa Clem.

This species differs so little from *S. gordius* that a detailed description is scarcely necessary. Its color differs somewhat, being a bright brown and occasionally is marked with black blotches. The maxillary loop is 3–4 mm. long, usually 3 mm., and usually strongly curved. It seldom extends as much as one-fourth the length of the wings, usually one-fifth, sometimes less. It appears slightly flattened, without any enlargement at the end, and is seldom so deeply striate as *S. gordius*. The circular area of sculpturing on the proximal part of the maxillæ has not yet been observed. The scar of the caudal horn is usually made prominent by a deep concavity behind it, but this varies somewhat. The cremaster is not as rugose as *S. gordius* and seldom shows lateral projections. The length of pupa is 33–38 mm., the greatest width 9 mm.

Sphinx gordius Cram.

Color very dark brown; head, thorax and appendages roughened with sculpturing, mostly transverse striations; abdominal segments finely punctate with wavy impressed lines between the punctures; maxillary loop 5–6 mm. long, usually 5 mm., extending for at least one-fourth the distance to the caudal margin of the wings, with deep irregular, transverse striations, usually excurved and slightly bulbous at tip; proximal portion of maxillæ more deeply sculptured, usually a circular area outlined on either side the maxillary loop; antennæ with four or five irregular rows of tubercles which cover the entire surface, those of the female extending about as far caudad as the prothoracic legs, while those of the male extend half way between the distal ends of the prothoracic and mesothoracic legs; prothoracic legs slightly swollen opposite the distal end of the maxillary loop; scar of caudal horn slightly elevated and punctate like the remainder of the segment; cremaster 3.5 mm. long, slender, the proximal part rugose, usually with sharp points on the lateral margins, the distal part smooth and ending in a sharp point. Length of pupa 38–42 mm., breadth 9 mm.

Sphinx chersis Hbn.

Color bright yellowish brown or chestnut brown, rarely with black blotches; head, thorax, and appendages roughened with deep wavy impressed lines, mostly transverse striations, and indistinct flattened tubercles; abdominal segments thickly punctate with wavy impressed lines between the punctures; lateral margins of the labrum very clearly defined and the clypeo-labral suture sometimes distinct, with two distinct, flattened tubercles on the clypeus adjacent to it; maxillary loop 13–15 mm. long, averaging 14 mm., and usually extending half the distance to the caudal margin of the wings, usually closely applied to the ventral surface of the body, sometimes very slightly elevated; antennæ variable as to markings, but oftenest showing one row of minute tubercles along the median line for at least part of the distance and never having more than two rows, and never having the lateral margins elevated; antennæ of female extending half-way between the distal ends of the prothoracic and mesothoracic legs, those of the male considerably farther, often to the distal end of the mesothoracic legs or beyond; sometimes a small portion of prothoracic femur exposed; metathorax seldom with a median ridge, but with a prominent carinate ridge on each side the meson extending at least half way across to the margin of the wing, usually darker in color than the remainder of the segment; scar of caudal horn smooth and polished, usually more distinct than in the preceding species, with a prominent concave area just caudad of it; cremaster about 2.5 mm. long, slightly longer than broad, rugose and bifurcate at tip. Length of pupa 50–58 mm., greatest width 13 mm.

Some authors have reported pupæ less than 50 mm. I have reared a great many of these from the egg and have never had them smaller, but have no doubt that the observation was correct as many factors influence the size of the pupa.

Sphinx drupiferarum A. & S.

Color dark purplish brown, the purple tinge more apparent in fresh pupæ; head, thorax and appendages roughened with deep, wavy impressed lines and indistinct tubercles, the latter most evident in the region of the clypeus and labrum; abdomen punctate, with the punctures larger on the cephalic third of segments 1–6 which is slightly elevated, and on the remaining segments, the punctures extending on the ventral surface; maxillary loop 9 or 10, rarely 11 mm. long, extending about two-fifths the distance to the caudal margin of the wings; surface of antennæ almost covered near the proximal end with indistinct tubercles which are scarcely visible on the distal half, the lateral margins very slightly elevated and often bearing a distinct row of minute tubercles; antennæ of male usually extend as far caudad as the prothoracic legs, those of the female shorter; mesothorax with an elevated median ridge, and an inconspicuous transverse ridge on either side of it near the cephalic margin of the segment, which never extends half-way across; scar of caudal horn smooth, with a concavity just caudad; cremaster 3–3.5 mm. long, longer than broad and slightly bifurcate at tip. Length of pupa 47–53 mm., greatest width 11 mm.

Alcoholic specimens of *S. drupiferarum* are rather hard to separate easily from *S. chersis*, because both become very dark brown or nearly black if the latter are placed in alcohol when nearly mature. The easiest way, if one has seen both species, is to examine the metathoracic ridges. The length and sculpturing of the antennæ usually will furnish a reliable means of separation, although the length does vary somewhat.

Sphinx kalmiæ A. & S.

Color bright reddish brown, sometimes marked with black; body appearing polished, the sculpturing shallow; head and thoracic segments slightly roughened with impressed lines; abdominal segments punctate with wavy impressed lines between, the punctures larger on the cephalic part of segments 1–8 and interrupted by short longitudinal depressions; maxillary loop 7.5–8 mm. long, extending one-third of the distance to the caudal margin of the wings, slightly raised from the surface and touching only at the bulbous tip; antennæ with a distinct row of small tubercles extending along the median line for about two-thirds of the length, the lateral rows very indistinct or wanting; antennæ in both sexes nearly of equal length extending to, or very slightly beyond, the prothoracic legs; scar of caudal horn not very distinct, identified by a smooth polished area; cremaster 2–2.5 mm. long, very rugose, shallowly bifurcate at tip. Length of pupa 35–45 mm., greatest width 9 mm.

Sphinx eremitus Hbn.

Color chestnut brown, often marked with black; body surface polished, the sculpturing as in *S. kalmiæ;* maxillary loop 9.5–10 mm long, extending nearly half the distance to the caudal margin of the wings, slightly elevated from the body and touching only at its bulbous tip; antennæ with two indistinct rows of small tubercles along the median line, these often confluent so as to form an elongate tubercle; antennæ of female extending half way between the distal ends of the prothoracic and mesothoracic legs, those of the male a little longer; metathorax with a low but distinct, carinate ridge on each side the meson which extends nearly half way across the segment; scar of caudal horn slightly elevated, smooth and polished, usually without a concave area caudad; cremaster 3 mm. long, slender, slightly rugose and ending in a smooth sharp point. Length of pupa 35–38 mm., greatest width 9 mm.

Genus **Lapara** Wlk.

This genus is very closely related to Daremma as far as pupal characters are concerned. It has no maxillary loop and but one spiracular furrow. Normally the species of Lapara are smaller than Daremma, but the individuals of approximately the same size are rather hard to distinguish. The scar of the caudal horn is not very distinct in Daremma, being punctate as the remainder of the segment, so this very important character in the larva is not very helpful in the pupa, except that in Daremma the characteristic depression caudad of the scar is practically always present. The entire surface of the pupa appears polished in Daremma with fine scattered punctures on the abdominal segments. In Lapara the surface appears dull and the punctures on the abdominal segments are almost obscured by the impressed lines. The wings, too, are deeply sculptured in Lapara, but almost smooth in Daremma. The body in Lapara is typically sphingiform with the labrum always on the ventral surface. There is no maxillary loop and the maxillæ extend nearly to the caudal margin of the wings. The glazed eye-pieces are a little larger than in the members of the subfamily previously studied, and the impressed line on the mesal margin touches both antenna and maxilla. The antennæ are roughened with irregular rows of minute tubercles. The swelling of the prothoracic legs, which is so noticeable in most members of the subfamily, is very slight in both species of this genus. The cremaster is always longer than broad and ends in a sharp point. This genus includes two North American species which resemble each other very closely. Indeed they are so closely related as to make one doubt that there are two species here. Unfortunately it has been impossible to breed these species so that all data is obtained from purchased specimens. The individuals vary almost as much from each other as the species do. For example, the maxillæ in some individuals of *L. coniferarum* instead of extending to the caudal margin of the wing, as they appear to do normally, are overlaid by the wings so that they are apparently shorter and like a typical *bombycoides.* The following are the characteristics which seem best to separate the two species:

a. Annulets distinct on the first three abdominal segments; punctures larger on the dorsum of the cephalic half of abdominal segments 1-7; spiracles with width more than twice the length........................*L. coniferarum*
aa. Annulets not distinct on the first three abdominal segments; punctures scarcely larger on the dorsum of the cephalic half of abdominal segments 1-7; spiracles with width about twice length..............*L. bombycoides*

Lapara coniferarum A. & S.

Color chestnut brown, usually with black blotches; surface of body dull; head, thorax and appendages with rather deep impressed lines making the surface rough; abdomen punctate, the punctures considerably larger near the cephalic margin of the first six segments and obscured by impressed lines, the remaining segments distinctly punctate, with the punctures more nearly of uniform size; labrum elevated, usually rugose; mandibular area elevated forming irregular tubercles; maxillæ normally reaching the caudal margin of the wings, but sometimes overlaid by the wings near the distal end; antennæ of male extending as far caudad as the prothoracic legs, those of the female a little shorter; median line distinct on the thorax, generally carinate on the prothorax; abdominal segments 1-3 with very distinct annulets; scar of caudal horn never present; cremaster slightly rugose, 2 mm. long, ending in a minutely bifurcate spine. Length of pupa 25-32 mm., greatest width 6-7 mm..

This species is exceedingly variable, especially in regard to the sculpturing of the body.

Lapara bombycoides Wlk.

This species varies but slightly from the preceding. It is usually a little larger so far as observed. The body seems to be a little smoother especially on the wings, which are not sculptured so deeply, and on the abdominal segments where the punctures are not much larger on the cephalic margins of the segments 1-7, nor on the remaining segments. The annulets are not distinct on any of the segments. The spiracles are a little smaller and more circular than in the preceding species. Length of pupa 30-35 mm., greatest width 6 mm.

Subfamily SMERINTHINÆ.

There are but three American genera belonging here. Smerinthus (including Paonias), Pachysphinx and Cressonia. These differ from all other sphingid pupæ in the possession of short maxillæ and broader antennæ than is usual. They approach more nearly to the saturnian type of pupa, and many of them have been reported as spinning cocoons. The labrum is in the position normal to all lepidopterous pupæ. They show no trace of the prothoracic femur and are in that respect more specialized than most of the Archerontiinæ. The eye-pieces are very like the preceding subfamily except that they usually touch at one point. The antennæ vary in the sexes being longer and wider in the males. The spiracular furrows which are three or four in number, punctate, and separated by interrupted ridges, are almost identical in all of these pupæ except Cressonia, which has only one deep spiracular furrow, thus showing kinship with the Acherontiinæ. Cressonia is not very closely related in many respects to this group, and seems to be a rather aberrant form. Its maxillæ and antennæ, however, show that it belongs here.

Genus **Smerinthus** Latr.

It has been impossible for me to find any characters which will serve to separate the genus Smerinthus from Paonias, so all species have been included under one generic name. The species are so extremely variable that it is impossible to give a species description which will fit all the individuals, and makes it exceedingly difficult to separate them. The head, thorax and appendages are somewhat roughened with impressed lines, and the abdomen has both punctures and impressed lines, yet in most cases the body presents a polished appearance. The labrum is always on the ventral surface. The maxillæ are short, only about one-third the length of the wings and there is no maxillary loop. The antennæ are fairly constant in length in most of the species. They are a little shorter and narrower in the female than in the male. In the female their greatest width is about equal to that of the prothoracic legs. Both prothoracic and mesothoracic legs as well as the metathoracic wings meet on the meson caudad of the maxillæ. The thorax usually has a slightly elevated median line, most prominent on the metathorax. The spiracular furrows are very shallow. The outer furrows are sparsely punctate, while the inner ones are practically obscured by large deep punctures, very close together so as to appear honeycombed, an extension of the punctate area on the dorsal cephalic margin of each movable segment. The cremaster is triangular, scarcely longer than broad and usually very rugose.

The following key may help to separate these species:

- a. Pupæ 35-43 mm. in length; greatest width, 11 mm.............. *S. excæcata*
- aa. Pupæ of smaller size.
  - b. Greatest width, 8 mm. or less; body of nearly uniform sculpturing; smooth band along cephalic margin of abdominal segments 5-7, usually sparsely punctate or wrinkled.............................. *S. astylus*
  - bb. Greatest width at least 9 mm.
    - c. Spiracles about 1 mm. across.............................. *S. myops*
    - cc. Spiracles less than 1 mm. across, usually .5 or .6 mm.
      - d. Antennæ varying in the sexes, those of the female shorter and not extending as far caudad as the prothoracic legs; surface of antennæ elevated and either smooth or with one row of minute tubercles. *S. jamaicensis*
      - dd. Antennæ not varying in the sexes, in neither sex extending much farther caudad than the maxilla; surface of antennæ roughened with three or four interrupted rows of minute tubercles.................. *S. cerisyi*

Smerinthus jamaicensis Dru.

Color chestnut brown or darker, occasionally marked with black; surface polished and glossy; head, thorax and appendages with shallow impressed lines, mostly transverse, the abdomen with rather coarse punctures more distinct on segments 1-3 and 8-10, an irregular row or two of larger punctures along the cephalic margins of segments 1-7, these so close together on the movable segments as to give it a honeycombed appearance; segments 4-7 with the punctures connected and obscured by irregular impressed lines; segments 5-7 with a slightly elevated smooth, polished area on the dorsum just caudad of the larger punctures along the cephalic margin; maxillæ short extending a trifle over one-third the distance to the caudal margin of the wings; antennæ of male longer and broader than those of the female, in the male extending almost as far caudad as the mesothoracic legs, in the female not as far as the prothoracic pair; surface of antennæ either smooth or with one row of minute tubercles on the median line; scar of caudal horn slightly elevated, with a slight concavity just caudad of it; cremaster very rugose with short projections along the lateral margins, ending in a blunt point, and frequently curved slightly dorsad. Length of pupa 30-35 mm., greatest width 9 mm.

Smerinthus cerisyi Kirby.

The only constant difference found between this species and the preceding one is that the antennæ do not show sexual variation and in neither sex do they extend as far caudad as the prothoracic legs. The surface is roughened with about three rows of minute tubercles in addition to the transverse striations found in both species. This species is apparently a little larger, being from 32–37 mm. long and about 9 mm. wide. I have never bred this species and have only a few pupæ, but these characters were constant for the individuals examined.

Smerinthus excæcata A. & S.

This species is so variable that it is impossible to write a detailed description that would fit better than the description of *S. jamaicensis* which it strongly resembles. The sculpturing varies very much. The color is usually a bright brown, but varies from chestnut to a very dark brown. The antennæ vary in the sexes, those of the male extending about half way between the distal ends of the prothoracic and mesothoracic legs, while those of the female are considerably shorter and do not nearly reach the tips of the prothoracic legs. The species may always be distinguished by its large size, being both longer and stouter than any of the closely related species. The length is from 35–43 mm., greatest width 11 mm.

Smerinthus myops A. & S.

This is normally easily distinguished from the other species included in the genus Paonias, on account of its size but it is exceedingly difficult to separate from *S. jamaicensis* and *S. cerisyi*. The only constant character found so far is the size of the spiracles, those of *myops* being a millimeter across, but in the other two species scarcely more than half of this. The color of *myops* varies greatly, but is often a deep purplish brown, which color has not been noticed in other species of the genus. The antennæ vary with the sex, as in *S. jamaicensis*, extending slightly farther caudad than the maxillæ in the female, and as far or farther than the prothoracic legs in the male. The sculpturing of the antenna varies greatly in this species. The length is from 30–36 mm., greatest width, 9 mm.

Smerinthus astylus Dru.

This species is more slender than *myops*, so far as observed, never being over 8 mm. in greatest width. The sculpturing is usually not so deep as on the other species and does not obscure the punctures on any of the abdominal segments. The smooth area along the cephalic margin of segments 5-7 is usually wrinkled or sparsely punctate, and never as distinct as in other species. The punctures on the abdominal segments are never as close together, and the body is more uniformly sculptured throughout. Length of pupa 30–35 mm., greatest width 7.5–8 mm.

Genus Pachysphinx R. & J.

The pupæ of this genus very strongly resemble some of the Saturniidæ. The body is broad in proportion to its length and of practically the same width throughout, being narrowed but very little at the cephalic end. The surface is rather coarsely sculptured and shows distinct annulets on the dorsum of the abdominal segments. The labrum is on the ventral surface.

The shallow spiracular furrows are almost obscured by coarse punctures. The scar of the caudal horn is never prominent, and sometimes not distinguishable. The cremaster is short and somewhat quadrangular, usually ending in a very short, sharp point.

There is a single species of this genus in North America, *P. modesta*, which ranges from Atlantic to Pacific, mostly in the northern half of the United States.

Pachysphinx modesta Harr. (Fig. 5).

Color varies from chestnut brown to almost black; surface of head, thorax and appendages roughened by very deep, interrupted, transverse impressions and fine granulations making it dull, the abdomen coarsely punctate, with annulets on the dorsum, but appearing polished, the cephalic margins of the segments always more densely punctate; clypeo-labral suture always distinct; antennæ of female with a single row of tubercles, extending as far caudad as the prothoracic legs, those of the male without tubercles and extending as far as the mesothoracic legs; maxillæ extend about two-fifths of the distance to the caudal margin of the wings. The cremaster is very rugose, occasionally triangular, and 2 mm. or less in length. Length of pupa 40-50 mm., usually about 50, greatest width 13-15 mm.

A pupa of *P. modesta imperator*, bred by Mr. H. H. Brehme, of the New Jersey Entomological Co., showed no perceptible difference from the species.

Genus **Cressonia** G. & R.

The pupæ of this genus differ markedly from all other sphingids and should always be very easily distinguished. The body is somewhat of the saturnian type, but flattened ventrally on abdominal segments 7-10. The surface of the body is rough and spiny, and always appears dull. The clypeo-labral suture is distinct. The antennæ have a row of spiny tubercles along the median line and do not differ in the sexes. There is but one deep spiracular furrow which extends both dorsad and ventrad of the spiracles. The cremaster is short, broader than long, truncate at the tip.

This genus consists of a single species, *C. juglandis*, which is found almost everywhere in the United States east of the Mississippi and extends into Canada. As far as pupal characters go, it seems intermediate between Smerinthus and Pachysphinx of the Ambulicinæ and Lapara and Daremma of the Acherontiinæ.

Cressonia juglandis A. & S.

Color varies from reddish brown to nearly black, always dull and opaque; surface of body roughened with spines which are larger along the caudal margin of abdominal segments 4–7 and on the antennæ; head with six spiny tubercles, two between the bases of the antennæ, two on the clypeus and one on either side between the clypeus and glazed eye, almost in line with the clypeal tubercles; clypeo-labral suture distinct; antennæ in both sexes extending as far caudad as the prothoracic legs; maxillæ extending for a little more than one-third of the distance to the caudal margin of the wings; abdominal segments showing annulets on the dorsum, segments 4–7 with a prominent lateral ridge covered with curved spines which project cephalad; segments 9–10 with longitudinal wrinkles on the dorsum: scar of caudal horn very prominent with a rounded spiny elevation just laterad on each side; cremaster 1 mm. or less long, the caudo-lateral angles usually produced into sharp points. Length of pupa 28–38 mm., greatest width 9 mm.

Subfamily SESIINÆ.

The members of this subfamily in America belong to the genera Pseudosphinx, Hæmorrhagia, and Erinnyis. Pseudosphinx does not have any spiracular furrows, whereas the other genera have them extending for a considerable distance dorsad and ventrad of the spiracle. The members of this subfamily, in common with Pholus and Proserpinus, have a very peculiar type of ridge on the mesothorax, caused mostly by the deep furrows which surround it. The general type of body is the same in these genera, differing markedly from the remaining genera of Philampelinæ. The labrum is sometimes on the cephalic end of the body, but oftener pushed back on the dorsal surface. The antennæ are filiform and may vary slightly in length in the sexes, but not otherwise. The eye pieces are much like the Acherontiinæ, except that they come nearer to touching the maxillæ. The Sesiinæ, and the two genera of Philampelinæ which resemble them, all have another character in common, a portion of the prothoracic femur exposed, showing them to be more generalized than the remainder of the Philampelinæ. This is only present in some individuals in Hæmorrhagia, which is in other respects by far the most specialized of the group.

Genus **Pseudosphinx** Burm.

The pupæ of this genus are typically sphingiform. The head is visible mostly on the dorsal surface. The labrum is only visible in cephalic view, and the clypeo-labral suture is never wanting. The maxillæ extend from the cephalic end of the body to the caudal margin of the wings and are slightly swollen and excurved at the proximal end. Each mandibular region is slightly elevated into a low tubercle, and these are visible at the end of the body in ventral view. The antennæ are slightly elevated along the flagellum. The metathorax has a prominent ridge and the median line is also elevated. There are no spiracular furrows present. The cremaster is triangular, ending in a slightly bifurcate tip.

Pseudosphinx tetrio L.

Color black in alcoholic specimens, living ones marked with red, occasionally with red predominating, but usually marked with red on the transverse conjunctiva and on the head, thorax and appendages, particularly on the ventral surface; body surface smooth and glossy, with very faint impressed lines, but scarcely punctate except along the cephalic margin of the movable segments; abdominal segments showing annulets and somewhat wrinkled dorsally; antennæ smooth, slightly longer in the male, those of the female extending just beyond the prothoracic legs; exposed portion of prothoracic femur 3–4 mm. long, the greatest width, .5 mm.; cremaster finely rugose, 4 mm. in length, slightly broader than long with a distinctly bifurcate point at tip. Length of pupa 65–75 mm., greatest width 15 mm.

Genus **Erinnyis** Hbn.

In this genus the body is typically sphingiform and the females are very much larger than the males. The labrum is only visible at the cephalic end of the body. The maxillæ extend to the caudal margin of the wings. The antennæ are slightly longer in the male and extend beyond the prothoracic legs, while those of the female seldom do. There are four or five shallow spiracular furrows on the fifth segment, separated by carinate ridges, but there are none present on the other movable segments. The abdominal segments are thickly punctate along the cephalic margin, and this area is slightly elevated. The scar of the caudal horn is small and variously indicated, usually by a slight elevation and radiating furrows. The cremaster is triangular but not bifurcate at tip.

This genus consists of a number of species which may be found in Florida and two of these at least are found farther north, *E. alope* and *E. ello*. These species may be separated as follows:

a. Predominating color usually red; cephalic portion of abdominal segments with the punctures mostly confluent; cremaster longer than broad. . .*E. alope*
aa. Predominating color usually black; cephalic portion of abdominal segments not usually confluent; cremaster with length and breadth equal. . . . . .*E. ello*

Erinnyis alope Dru.

Color orange red or vermilion, marked with black, the proportion of color varying; head, thorax and particularly the appendages marked with longitudinal stripes; abdomen with two transverse rows of black dashes more or less united on the ventral surface, a black stripe along the caudal margin and a black dot on either side the meson between the rows of dashes, these dots occasionally modified into dashes; spiracles ringed with black; body smooth and polished; surface of head and thorax with fine transverse striations, these scarcely visible on the appendages; abdominal segments with an elevated punctate band along the cephalic margin of segments 2–7, the punctures denser and confluent on 5–7, the remainder of the surface almost smooth except near the spiracles where it is transversely striate; maxillæ extending over the curve of the head at their proximal end and to the caudal margin of the wings; antennæ extending to the distal end of the prothoracic legs in the male, a little shorter in the female; exposed portion of prothoracic femur about 5 mm. long and .5 mm. broad; metathorax with ridges as in Pseudosphinx; spiracular furrows about 6 mm., long, extending both dorsad and ventrad of the spiracle; annulets faintly indicated on the first three abdominal segments; scar of caudal horn usually a smooth, circular, polished area with finely radiating furrows; cremaster very finely rugose, 2 mm. long, not quite as broad. Length of pupa 50–60 mm., greatest width 13 mm.

Erinnyis ello L. (Fig. 6).

This species differs but little from the preceding species except that it usually has less red and this is a darker red, so that the black markings do not show so plainly. In fact the pupa appears to be black, rather than red. There is a distinct black dash instead of a dot normally present between the two rows of black dashes on the abdominal segments. The annulets are much more distinct in this species, being visible on all the segments. The punctures along the cephalic margins of the segments are not usually confluent as in *alope*. The cremaster has the length and breadth equal, about 2 mm. Length of pupa 43–53 mm., greatest breadth 11–13 mm.

Genus **Hæmorrhagia** Grt.

In this genus the body is typically sphingiform, considerably narrowed at the cephalic end, and the labrum is visible only in dorsal and cephalic views. The maxillæ extend to the caudal margin of the wings. The antennæ are slightly elevated along the flagellum, and length and breadth appear equal in both sexes. There is often a small portion of the prothoracic femur exposed, but this is usually so narrow as to scarcely be noticed. The pupæ of this genus differ from all the others examined, except *Celerio gallii*, in having spiracular furrows on two abdominal segments, five and six, while the others have them on either one or three segments or not at all. *Celerio gallii* has short, interrupted ridges separating the furrows. There are four or five long furrows which extend for an almost equal distance dorsad and ventrad of the spiracles. The body is sculptured practically all over the surface, except the scar of the caudal horn which appears polished. The cremaster is triangular, longer than broad, coarsely punctured and bears numerous hooks curved caudad with a larger double hook at the distal end. The pupæ of this genus are among the few which are found in cocoons. The larvæ drop to the ground to pupate and fasten bits of leaves or other debris together with silk to form the cocoon. The larvæ of *H. diffinis* have been so abundant on snowberry and various bush honeysuckles in Urbana as to be a serious pest.

It is extremely difficult to separate the pupæ of this genus. *H. thysbe* and *H. diffinis* are both common species and after rearing hundreds of them I hesitate to attempt a key to separate these two common species. The larvæ are very variable as to coloring and often difficult to distinguish on this account. The pupæ of *H. diffinis* are slightly smaller, averaging 25 mm., but are so variable in size that this factor counts for little. They are not so much excurved ventrally, but this difference is hard to put into exact measurements. The greatest width of *H. diffinis* averages 7 mm., of *H. thysbe* 8 mm. The description of *H. diffinis* will be given, as more specimens have been reared of that species.

Hæmorrhagia diffinis Bdv.

Color varying from dark reddish brown to brownish black, with a lighter conjunctiva on the movable segments, this difference nearly always visible in alcoholic specimens; body surface dull, somewhat shagreened, the head, thorax and abdominal segments roughened with impressed lines, mostly transverse, the abdominal segments finely, thickly punctate, with the punctures mostly confluent, conjunctivæ smooth and silky in appearance; prothoracic femur sometimes showing a narrow portion about 1.5 mm. long; antennæ roughened, with transverse striations, scarcely tuberculate, extending half way between the distal ends of the prothoracic and mesothoracic legs; metathorax with a prominent transverse ridge set off by a distinct furrow on each side; abdomen sometimes showing traces of annulets on the first three segments; cremaster 1.5-2 mm. long, rugose and punctate. Length of pupa 20-27 mm., greatest width 6-7 mm.

Subfamily PHILAMPELINÆ.

Of the genera comprising this subfamily, Pholus and Proserpinus have been discussed in connection with the Sesiinæ. The remaining genera, Ampelœca, Darapsa, Sphecodina, Deidamia, and Amphion, together with Proserpinus are included in one tribe by Rothschild and Jordan while Pholus is in another. I can scarcely understand the position of Proserpinus, but as so few of these forms have been available for study, hesitate to express an opinion. With this exception the group consists of rather short, somewhat "stumpy" pupæ, with the labrum usually near the cephalic end of the head, but not carried over on the dorsal surface. The maxillæ always reach the caudal margin of the wings, but are often excurved at the proximal end. The antennæ are normal. There is never any portion of the prothoracic femur visible, except in Darapsa and Pholus. The glazed eye-piece usually touches both antenna and maxilla. There are no spiracular furrows present.

Genus **Pholus** Hbn.

The pupæ of this genus are among the largest of our common species, normally two inches or more in length. The body is typically sphingiform with a distinct "shouldered" appearance, and always bright chestnut brown. The labrum is on the dorsal surface a short distance from the cephalic end of the body, so that the maxillæ rise on the dorsal aspect of the head and extend to the caudal margin of the wings. The mandibular region usually shows a prominent tubercle on each side the labrum and these are prominent in dorsal view. The antennæ are filiform and slightly longer in the male. A small portion of the prothoracic femur is always exposed. The metathorax has a prominent transverse ridge on each side the meson. The scar of the caudal horn is always smooth and polished. The cremaster is triangular and usually ends in a sharp point.

There are seven species of Pholus in North America but only two of these are common in the east. These species may be separated as follows:

a. Head longer than broad as seen in lateral view, the distance from the cephalic margin of the glazed eye to the anterior end of the body three times or more the length of the eye-pieces. . . . . *P. achemon*
aa. Head broader than long as seen in lateral view, the distance from the cephalic margin of the glazed eye-piece to the anterior end of the body twice the length of the eye-pieces. . . . . *P. satellitia pandorus*

Pholus achemon Dru. (Fig. 7).

Proximal part of maxillæ, head and thorax roughened with indeterminate transverse striations, or often somewhat granular, the appendages usually smooth and polished, abdominal segments coarsely densely punctate on the cephalic margin, but more sparsely punctate on the remainder; head noticeably narrowed as seen in ventral view; in lateral view the distance between the cephalic margin of the glazed eye-piece and the cephalic end of the body is at least three times the length of both eye-pieces; antennæ scarcely tuberculate, sometimes with a minute, mesal row on the proximal half, a little longer in the male, extending to, or slightly beyond, the distal ends of the prothoracic legs; portion of prothoracic femur exposed about 4 mm. long and 1 mm. wide; annulets seldom distinct on the abdominal segments; scar of caudal horn smooth and polished; cremaster rugose 2-3 mm. long, longer than broad, but variable as to breadth. Length of pupa 50-65 mm., greatest width 12-13 mm.

Pholus satellitia pandorus Hbn.

Body stouter than in *P. achemon*, head not so much narrowed as seen in ventral view, in lateral view the distance from the cephalic margin of the glazed eye-piece to the end of the head is about twice the length of the eye-pieces; head, thorax and usually the appendages roughened with striations and impressed lines, sometimes finely granular, abdominal segments coarsely punctate, more densely punctate along the cephalic margin; antennæ usually smooth, sometimes with minute tubercles mesad of the median line, longer in the male extending to, or in some male specimens one-third of the distance between the distal ends of the prothoracic and mesothoracic legs; annulets usually distinct on the dorsum of the abdominal segments; cremaster triangular, variable as to width, ending in a sharp point which is somewhat bifurcate. Length of pupa 52-65 mm., greatest width 14-15 mm.

Genus **Ampelœca** R. & J.

The pupæ of this genus belong to the small number among lepidopterous pupæ which are not dark brown or black, but instead a very light brown or coffee color with darker markings. They are not of the typical sphingid shape but rather blunt at the cephalic end, and the labrum is always on the ventral surface. The maxillæ reach the caudal margin of the wings. There is never any portion of the prothoracic femur exposed. The antennæ are slightly broader on the cephalic half. There is a conspicuous row of large punctures extending along the dorsal cephalic margin of the eighth segment, which has not been noted in any of the other sphingid pupæ studied. The scar of the caudal horn is smooth and polished, occasionally showing a small tubercle on each side the meson.

This genus includes two species in North America which may be separated as follows:

a. Abdominal segments 7-10 tapering gradually to a point, somewhat triangular in outline; cremaster triangular, bifid at tip. . . . . *A. myron*
aa. Abdominal segments 8-10 rounded abruptly at end of body, almost semicircular in outline; cremaster a sharp spine scarcely broader at the proximal end. . . . . *A. versicolor*

Ampelœca versicolor Harris.

Color grayish or coffee color often with a pinkish tinge, sometimes darker in mature pupæ, dotted with black, the eye-pieces and spiracles conspicuously black; body rather stout and more cylindrical than is typical in sphingid pupæ, rounded abruptly at the caudal end; surface of body dull and roughened with wavy impressed lines, with fine punctures on the cephalic margin of each movable segment and around the spiracles; abdominal segments 8–10 coarsely punctate; antennæ extending as far caudad as the prothoracic legs; distinct spiracular furrows not present, the region cephalad of the spiracles finely punctate with no indication of ridges; cremaster 2–3 mm. long, a slender sharp spine, not noticeably wider at the proximal end. Length of pupa 35–40 mm., greatest width 10 mm.

Ampelœca myron Cram.

Color usually light brown finely dotted with black, the eye-pieces, spiracles and conjunctiva of the movable segments black or dark brown; surface of body dull, roughened with wavy impressed lines, abdominal segments 1–7 distinctly, finely punctate with much coarser punctures on the remaining segments; antennæ extending as far caudad as the prothoracic legs; distinct spiracular furrows not present, but a series of low interrupted ridges are distinctly visible over the spiracles of the fifth segment; cremaster about 2 mm. long, triangular, much longer than broad and slightly bifurcate at tip. Length of pupa 30–38 mm., greatest width 9–10 mm.

Genus **Darapsa** Walk.

The pupæ of this genus differ markedly from those of the genus Ampelœca. They are the only sphingid pupa examined in this study excepting Cressonia which have rows of spines on the segments. As far as other characters are concerned, it resembles Deidamia most closely, as it has a low tubercle mesad of each eye-piece and the proximal part of the maxillæ prominently excurved, but scarcely carinate. Each mandibular area has a low, indistinct tubercle which is visible in ventral view. The maxillæ extend to the caudal margin of the wings. A small portion of the prothoracic femur is exposed. The antennæ are similar in the sexes. The scar of the caudal horn is more rugose than the remainder of the segment. The cremaster is triangular and sharply pointed. This genus includes a single species *D. pholus*. The species has been commonly known in this country as *Ampelophaga chærilus*.

Darapsa pholus Cram.

Color light brown to darker brown, mottled with darker brown or black, somewhat resembling the coloring of Ampelœca species, spiracles and conjunctiva black; entire surface of body dull and roughened with wavy impressed lines, the sculpturing deeper on the head, thorax and appendages; abdominal segments 5–6 with two or three interrupted rows of spines on the dorsum, becoming a single row near the spiracles, segment 7 with one row on the dorsum, but more near the spiracles; the spines very small on the ventral surface; annulets faintly indicated on the dorsum of segments 1–3; segments 8–9 punctate, the ninth segment almost smooth; antennæ almost smooth, without prominent tubercles, extending a little farther caudad than the prothoracic legs; portion of prothoracic femur exposed about 1.5 mm. long and .5 mm. wide; cremaster rugose, about 3 mm. long, triangular, longer than broad, usually slightly curved and ending in a sharp point. Length of pupa 35–37 mm., greatest width 9 mm.

Genus **Sphecodina** Blanch.

The pupæ of this genus have a longer cremaster in proportion to their size than most other pupæ of the family except Amphion, where it is twice as long as broad. The body is sphingiform but stout, with the labrum visible in ventral view. The maxillæ extend to the caudal margin of the wings. The antennæ are similar in the sexes and are a little wider on the cephalic half. The metathorax has a transverse furrow extending about half-way across the segment. The scar of the caudal horn is always easily distinguished. The cremaster is triangular, and pointed at the distal end, with length and breadth approximately equal.

Sphecodina abbotti Swains.

Color chestnut brown or darker, usually darker on the dorsum, and somewhat mottled, especially on the appendages; surface dull, the head, thorax and appendages with fine impressed lines, the abdomen punctate, the punctures of medium size and connected on the first six segments with impressed lines; annulets indicated on the first five abdominal segments, the ninth usually quite smooth and polished; scar of caudal horn usually elevated, smooth and polished; cremaster rugose, 3 mm. long, ending in a sharp point. Length of pupa 35–40 mm., greatest width, 9 mm.

Genus **Deidamia** Clemens.

The pupæ of this genus are very easily distinguished by the three prominent projections on the head, the excurved, carinate proximal portion of the maxillæ and the very coarse punctures on the caudal abdominal segments. The body is somewhat fusiform with the labrum at the cephalic end. The labrum bears the median projection of the head, a very rugose, usually blunt tubercle. The lateral tubercles are also rugose, pointed and situated just mesad of the eye-pieces. The maxillæ are of the usual type, distinctly carinate on the proximal third and extend to the caudal margin of the wings. The antennæ are similar in the sexes and bear a prominent row of tubercles along the median line. The scar of the caudal horn is prominent. The cremaster is triangular and pointed. On all the pupæ examined there were prominent projections on the ventral surface of the tenth abdominal segment, apparently the remains of the anal prolegs.

Deidamia inscriptum Harr. (Fig. 8).

Color variable, fresh pupæ often light brown with darker brown on the appendages and dorsum, others very dark brown all over; surface of head and prothorax with deeper, broader sculpturing than is usual on pupæ; mesothorax and metathorax and appendages almost smooth with shallow sculpturing; abdominal segments punctate, the punctures very deep and coarse on the cephalic margins of the first seven segments and on segments 8–10, punctures finer and sparser on the remaining parts; antennæ extend as far caudad as the mesothoracic legs; spiracles prominent with smooth elevated rings; scar of caudal horn usually smooth, often with prominent radiating furrows; cremaster scarcely 2 mm. long, very rugose with a smooth tip. Length of pupa 30–33 mm., greatest width 9 mm.

Genus **Amphion** Hbn.

In this genus the caudal half of the body is much narrower and more tapering than the typical sphingid, indeed more than any of the other sphingid pupæ examined. This, together with the long pointed cremaster and the small tubercles at the cephalic end, are quite distinctive. The labrum is at the cephalic end of the body and the maxillæ extend to the caudal margin of the wings. The scar of the caudal horn is easily recognized. The cremaster is about twice as long as broad and ends in a sharp point, which is occasionally bifid at tip.

Amphion nessus Cram.

Color uniform dark brown; surface of head, thorax and appendages dull, considerable roughened, with deep, wavy transverse furrows near the cephalic end, abdomen punctate, the punctures large and confluent on segments 1–4, lunate on 5–8, and deeper circular punctures on 8–10; mandibular tubercles nearly always prominent; antennæ of female extending half way between the tips of the prothoracic and mesothoracic legs, those of the male slightly longer; prothoracic femur never visible; maxillæ very rugose at cephalic end; cremaster rugose, usually 4 mm. long. Length of pupa 32–37 mm., greatest width 8–9 mm.

Genus **Proserpinus** G. & R.

The pupæ of this genus are small and slender, averaging about an inch in length. They are typically sphingiform, with the labrum at the cephalic end of the body, not visible in ventral view. There are prominent mandibular tubercles visible in ventral view at the end of the body. The maxillæ are of the usual type and extend to the caudal margin of the wings. The antennæ are filiform and apparently do not differ in the sexes. There is always a small portion of the prothoracic femur exposed. There are no spiracular furrows present, the cephalic margin of each movable segment is punctate like the adjacent portion. The scar of the caudal horn may usually be identified but is not very distinct. The cremaster is narrow and triangular, ending in a sharp point.

There are probably only three species of Proserpinus, two occurring in this region, and it has only been possible to obtain pupæ of *P. juanita* and *P. gauræ*. These are found in the southern part of the United States. As only one specimen of *P. gauræ* was obtained its variations could not be noted. It seemed to differ from *P. juanita* in one important particular which I should hesitate to use were it not for the fact that the figure in Smith and Abbott's "Lepidopterous Insects of Georgia" shows the same characteristic.

a. Head bent forward ventrally, the proximal part of the maxilla considerable swollen so that the ventral margin of the body as seen in lateral view is prominently excurved at the cephalic end........................*P. gauræ*

aa. Head never bent forward ventrally, the proximal part of maxilla only slightly swollen and the ventral margin of the body as seen in lateral view is practically straight..*P. juanita*

So far as it is possible to observe from a single specimen, the only differences in the two species are listed above. It is therefore necessary to give but the description of *P. juanita.* The specimen of *P. gauræ* Strecker examined was 28 mm. in length and the greatest width was 6 mm.

Proserpinus juanita Stkr.

Color chestnut brown sparsely dotted with black; surface of head and thorax with very shallow impressed lines, fainter on the appendages, appearing polished, abdominal segments punctate, 2–7 more densely punctate along the cephalic margin and over nearly the cephalic half of the segment, 8–10 over the entire segment; mandibular areas each with a distinct tubercle, prominent in ventral view; maxillæ slightly swollen near the proximal end; antennæ vary in length somewhat though this is not a sexual difference apparently, in some they extend as far caudad as the prothoracic legs, in others half way between the prothoracic and mesothoracic legs; portion of prothoracic femur exposed about 2 mm. long, less than .5 mm. broad; metathoracic ridge black, often wrinkled; scar of caudal horn often a distinct tubercle, at other times scarcely apparent; cremaster 2–3 mm. long, often slightly bifurcate. Length of pupa 27–33 mm., greatest width 6–7 mm.

Subfamily CHÆROCAMPINÆ.

The only common American genera belonging here are Xylophanes and Celerio. They have a number of spiracular furrows, separated by wavy interrupted ridges. They are long, slender pupæ with the wings extending for about three-fifths the length of the body. The prothoracic femur is exposed in Celerio. The antennæ vary but little in the sexes, and only in length. The maxillæ extend to the caudal margin of the wings and are sometimes excurved at the proximal end. The eyepieces are very much like those of the Acherontiinæ and usually do not extend nearly to the maxillæ.

Genus **Xylophanes** Hbn.

The pupæ of this species are of very much the same shape as those of the genus Pholus, but are very different in their coloring, those of Xylophanes being a dirty grayish or clay color with darker markings while the pupæ of Pholus are uniform dark brown. The pupæ of Xylophanes also lack the prominent "shoulders" of Pholus, and are generally typically sphingiform. The labrum is on the dorsal surface of the body. The maxillæ are of the usual type, and extend to the caudal margin of the wings. The antennæ of the male are longer than those of the female. There is no portion of the prothoracic femur exposed. There are spiracular furrows on the fifth segment. These are very shallow and separated by low, interrupted carinate ridges. The scar of the caudal horn may usually be identified. The cremaster is narrow and triangular, ending in a sharp point.

There are four species of this genus which may occur in this region but only one is common. The larva of one of these species is described, but according to Rothschild and Jordan the early stages of the other two are unknown. *Xylophanes tersa* is found in the southern part of the United States and has been collected in Illinois.

Xylophanes tersa L.

Color grayish or grayish brown, with an interrupted black median line on both dorsal and ventral surfaces, broad and more distinct on the dorsal surface, spiracles deeply ringed with black so that they form a row of large round spots, remainder of surface variously marked with black; entire surface of body with very fine, mostly transverse striations giving it a silky appearance, the abdominal segments also showing fine punctures; maxillæ prominently excurved at the proximal end; antennæ of male extending as far caudad as the prothoracic legs, those of the female always considerably shorter; spiracular furrows very shallow, extending over the whole cephalic margin of the segment down to the spiracles and separated by fine, more or less wavy, interrupted carinate ridges making the surface appear very rough, the furrows extending farther dorsal than ventral of the spiracle; cremaster 2-3 mm. long, about half as wide at base and ending in a sharp point. Length of pupa 40-50 mm., greatest breadth 10 mm.

Genus **Celerio** Oken.

The pupæ of this genus also strongly resemble those of the genus Pholus, perhaps more so than those of the preceding genus, as Celerio has very prominent mandibular tubercles in one species and lacks the excurved proximal portion of the maxilla. It may always be distinguished when fresh by its very light brown color, and the darker alcoholic specimens are readily separated by the spiracular furrows of the fifth abdominal segment. In this genus there is one inner, deeper furrow with four or five shallower interrupted furrows between it and the spiracle. The body is typically sphingiform. The eye-pieces differ somewhat from most of the nearly related pupæ as the glazed eye-piece with its median impressed line extends only about two-thirds of the distance between the antenna and the maxilla. The maxillæ are of the usual type and extend to the caudal margin of the wings. The femur of the prothoracic leg is visible. The antennæ are slightly longer in the male. The scar of the caudal horn is usually elevated. The cremaster is triangular, longer than broad, and ends in a sharp point, which may be slightly bifurcate.

There are two species of this genus found in Eastern North America, *C. lineata* and *C. gallii*. According to Rothschild and Jordan, we have the subspecies *C. gallii intermedia* in this country. The only specimen of the latter which I have seen was bred by Dr. Edith M. Patch, of the Maine Agricultural Experiment Station, and kindly loaned by her for this study. The larva was found feeding on Galium in that state.

The species may be separated as follows:

a. Mandibular tubercles very prominent on the dorsal aspect of the head; head pointed, the length and breadth approximately equal............*C. lineata*
aa. Mandibular tubercles scarcely elevated, never prominent; head blunt, the breadth much greater than the length............*C. gallii intermedia*

Celerio lineata Fabr (Fig. 9).

Color usually very light brown or coffee color, often marked with irregular blotches of darker brown; head, thorax and appendages roughened with indeterminate transverse striations very much deeper at the proximal end of the maxillæ, abdominal segments deeply punctate, the punctures larger along the cephalic margin and usually confluent over the entire segment; labrum on the dorsal surface of the head, slightly elevated adjoining the maxillæ; mandibular tubercles very prominent; antennæ of female extending as far caudad as the prothoracic legs, those of the male extending half way between the tips of the prothoracic and mesothoracic legs; exposed portion of prothoracic femur about 2 mm. long and .5 mm. broad, the tibia prominently elevated adjacent to it; spiracular furrows present only on the fifth segment, the ridges between carinate, wavy and broken, extending from the inner furrow to the spiracle; scar of caudal horn usually a slight elevation with radiating furrows; cremaster 2 mm. long, rugose at base, the distal half smooth, bifurcate at tip. Length of pupa 40–50 mm., greatest breadth 10–11 mm. The pupæ of this species have been reared a number of times from larvæ found feeding on the common purslane. They enter the soil to pupate.

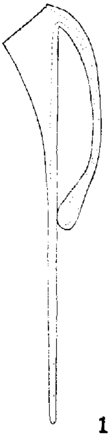
This is said to be the only cosmopolitan species of Sphingidæ.

Celerio gallii intermedia Kirby.

Color light brown, with darker brown appendages and darker punctures and blotches on the abdomen; head, thorax and appendages sculptured with indeterminate transverse striations, rather coarser than in *lineata*, abdomen punctate, the punctures somewhat confluent, and partly obscured by the sculpturing; labrum at the cephalic end of the body, not at all elevated; mandibular area scarcely elevated and not forming distinct tubercles; antennæ of female not extending as far caudad as the prothoracic legs; exposed portion of prothoracic femur 1–5 mm. long and less than .5 mm. broad, the tibia not elevated adjacent to it; spiracular furrows present and distinct on segments 5–6, with a trace of them on 7, the ridges separating them wavy, broken and carinate, extending from the inner furrow to the spiracle; scar of caudal horn indistinct; cremaster 2–5 mm. long, about half as broad, rugose nearly to the pointed tip. Length of pupa 48 mm., greatest width 10 mm.

EXPLANATION OF PLATE XXXVI.

Fig. 1. Maxilla of *Sphinx* sp., showing its doubling and the extreme length.
Fig. 2. *Herse cingulata*, lateral view.
Fig. 3. *Protoparce sexta*, lateral view.
Fig. 4. *Daremma catalpæ*, lateral view.
Fig. 5. *Pachysphinx modesta*, ventral view.
Fig. 6. *Erinnyis ello*, ventral view.
Fig. 7. *Pholus achemon*, lateral view.
Fig. 8. *Deidamia inscriptum*, lateral view.
Fig. 9. *Celerio lineata*, spiracular furrows.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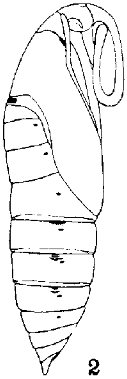
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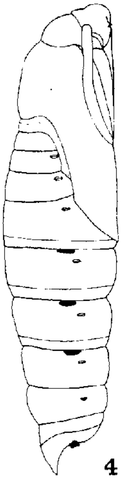
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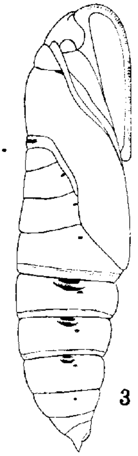
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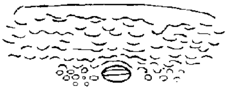
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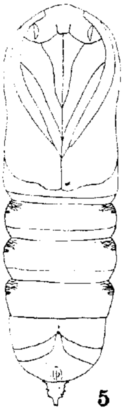
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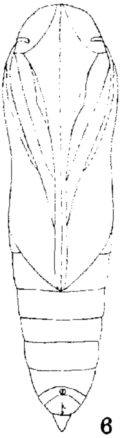
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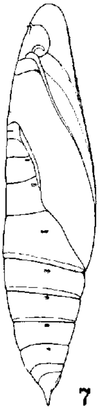
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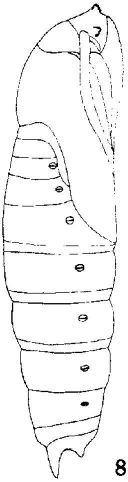
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Edna Mosher

RECORDS OF JAPANESE CRANE-FLIES (DIPTERA).

By Charles P. Alexander,
University of Kansas, Lawrence, Kansas.

The crane-fly fauna of Japan is a very interesting one but much remains to be ascertained before we can possess a clear conception of the actual faunal constituents of the islands. The published records are grievously incomplete and comparatively few extensive collections have been made. Some years ago (Canadian Entomologist, July, 1913,- July, 1914) the writer published a series of six papers on this subject. Since that time additional material has come to hand principally through the kindness of Dr. Akio Nohira and Dr. T. Miyake and the more interesting records included in this material are given herewith to supplement our knowledge of distribution. A few Limnobiinæ are redescribed in order to make their descriptions more available to American students, the original descriptions having been published in Japan in a publication not readily accessible to all students.

As is to be expected a large proportion of the known Japanese crane-flies are referrable to genera that are characteristically Holarctic (*Limnobia*, *Tricyphona*, *Eutonia*, *Crypteria*, *Liogma*, etc.). Others are referrable to groups with a wide or cosmopolitan distribution (*Dicranomyia*, *Geranomyia*, *Discobola*, *Erioptera*, *Gonomyia*, *Eriocera*, *Nephrotoma*, *Tipula*, etc.). A considerable element is clearly derived from the Oriental fauna through migrations from the south (*Libnotes*, *Conosia*, *Nesopeza*, *Ctenacroscelis*, etc.). The very interesting relationship of the fauna and flora of Japan and the Eastern United States, strikingly shown in many widely-separated groups of plants and animals is indicated in the Tipulidæ by the genus *Oropeza* Needham, at present known only from the eastern States and Japan. The subgenus *Hoplolabis* (*Erioptera*) indicates a somewhat similar condition although representatives also occur in the western States.

Ptychoptera japonica Alex.

Mt. Takao, Musashi, May 15, 1913 (T. Miyake).

Kioto, April 12, 1914 (Nohira).

Dicranomyia depauperata Alex.

Kioto, April 18, 1914 (Nohira).

Male.—Length, 5 mm.; wing, 6.6 mm.

Female.—Length, 6.2 mm.; wing, 7.8 mm.

Rostrum and palpi pale yellowish-brown. Antennæ with the scape yellow, the flagellum pale yellowish-brown. Head yellow.

Thorax dull yellow, with distinct greenish reflections, especially on the dorso-pleural membrane and near the coxæ. Halteres with the stem greenish, the knobs darker. Legs pale with the femora slightly greenish, the terminal tarsal segments brown. Wings with the veins and membrane pale, subhyaline. Venation: *Sc* short, ending before the origin of the arcuated sector; cell *1st* M_2 closed; basal deflection of Cu_1 at the fork of *M*.

Abdomen brownish-yellow, tinged with greenish, the apices of the segments more yellowish.

In life it is probable that the insect is quite greenish.

Limnobia avis Alex.

Takuhara, Province Shinano, September 4, 1915 (Nohira).

Male.—Length, 12.5–15 mm.; wing, 13.5–18.5 mm.

Rostrum and palpi dark brownish-black. Antennæ pale brownish-yellow. Head dark brown, the genæ paler brown.

Mesonotal præscutum obscure yellow, with three dark brown stripes, the median one broadest, indistinctly bisected by a reddish line; lateral stripes very short, not reaching the suture; scutum dull yellow, the lobes brown; scutellum and postnotum largely brown. Pleura dark brown and pale whitish-yellow. Halteres pale. Legs with the fore coxæ brown basally, yellow apically; remaining coxæ and the trochanters yellowish; femora yellowish, the tips broadly brown; tibiæ brownish yellow, narrowly tipped with brown; tarsi light brown. Wings yellowish, deepest on the costal region; veins and cross-veins narrowly seamed with brown, especially at the origin of the sector and along the cord; stigma largely pale. Venation: *Rs* angulated or spurred at origin; *r* at the tip R_1. Tip of the wing obtuse.

Abdomen with the four basal tergites yellow, with broad median and narrower lateral stripes; terminal tergites dark brownish; sternites similar, the four basal segments yellow, brownish laterally; terminal segments dark brown; hypopygium largely yellowish. The dorso-pleural appendage produced cephalad in a sharp point, the entire sclerite suggesting the head and beak of a bird.

Limnobia avis flavo-abdominalis Alex.

No specific locality, labeled March, No. 32.

Female.—Length, 13 mm.; wing, 13.4 mm.

Similar to the typical *avis*, differing as follows: Smaller. The head yellow with two, linear, brown, subparallel marks on the vertex; stripes on the præscutum represented only by two median black marks at the anterior end and four similar marks near the suture; scutal lobes black in the centers; legs yellow except the tips of the femora, which are very narrowly brown; abdomen clear yellow throughout.

Libnotes nohirai Alex.

Iwate, June, 1916.

Female.—Length, 10.5–13 mm.; wing, 15–17.4 mm.

Rostrum and palpi dark brown. Antennæ with the scape brown, the flagellum clear light yellow throughout. Head brownish-gray, clearer gray along the inner margin of the eyes.

Pronotum elongate, dark brown above. Mesonotal præscutum light brownish-yellow, whitish pollinose with four brown stripes, the median one extending the length of the sclerite, the lateral pair very short; scutum brown, lobes darker; scutellum and postnotum dark brown, sparsely gray pruinose. Pleura yellowish, the mesopleura slightly gray pruinose, darkest on the mesosternum. Halteres elongate, yellow, the knobs a little darker. Legs yellow, tips of the femora broadly black, tips of the tibiæ narrowly darkened; the last three tarsal segments and tips of the other two dark brown. Wings with a yellow tinge basally, more grayish distally. Veins, especially costa, bright yellow, except where they traverse dark spots, where they are brown; cross veins and deflections of veins, the radial sector and second anal vein narrowly seamed with dark brown. Venation: basal deflection of Cu_1 short, about as long as *r-m*.

Abdomen yellowish, the tergites more or less distinctly trivittate with dark brown.

Limnophila (*Eutonia*) *satsuma* (Westw.)

Kioto, May 10, 1914 (Nohira).

Limnophila japonica Alex.

Mount Tateyama, July 28, 1914 (Nohira).

Limnophila inconcussa Alex.

Kioto, April to June, 1916 (Nohira).

Limnophila (*Prionolabis*) *submunda* Alex.

Kioto, May 4 to 18, 1914 (Nohira).

Male.—Length, 6–6.5 mm.; wing, 7.8–8 mm.

Female.—Length, 7.2 mm.; wing, 8 mm.

Rostrum, palpi, head and antennæ black.

Thorax black, sub-shining. Halteres yellow. Legs with the coxæ and trochanters blackish; femora dull brownish-yellow basally, the tips broadly blackened, these dark tips broadest on the fore femora, where they include the outer two-thirds, narrowest on the hind femora where they include the apical third; remainder of the legs black. In the female the black apices are more extensive on all the legs and the femora are stouter, more clavate. Wings grayish-yellow, brighter yellow basally, and on the costa; stigma distinct, elongate-oval, dark brown; cross veins and deflections of veins seamed with pale brown. Venation as in *L. munda* O. S. (Eastern United States).

Abdomen black; valves of the female ovipositor rusty.

Limnophila (*Prionolabis*) *auribasis* Alex.

Osaka, April 26, 1914 (Nohira).

Female.—Length, 11.7 mm.; wing, 11.2 mm.

Similar to *L. submunda*, but much larger and more brightly colored. The legs are long and slender, the femora not incrassated as in the female of *submunda*. The basal portions of the femora are bright yellow, the wings are much brighter colored, suffused basally with deep orange.

Eriocera nipponensis Alex.

Kioto, May 28, 1914 (Nohira).

Male.—Length, 12 mm.; wing, 13.3 mm.

Rostrum dull yellow above, the palpi dark brown. Antennæ with the scapal segments conspicuously bright brownish-orange beneath, darker brown above; flagellum black. Head blackish, with a sparse brownish-gray pruinosity; genæ dull yellowish. Frontal tubercle prominent.

Mesonotal præscutum brownish-gray, with four distinct shiny black stripes, the median pair elongated, narrowed behind, becoming obliterated just before the suture; the remainder of the thorax black, sparsely silvery-gray pruinose, especially on the pleurites. Halteres short, light brown, the knobs darker. Legs with the coxæ blackish-gray; trochanters rusty yellow; femora rusty yellow, the tips blackened, these broadest on the fore femora, narrowest on the hind femora; remainder of the legs dark brown. Wings slightly infumed, the costal cell brownish; stigma small, rounded; indistinct brownish seams along the veins and deflections; an indistinct yellowish spot before the stigma. Venation: *Rs* elongate; cell M_1 lacking.

Abdomen black, sub-shiny.

Tricyphona vetusta Alex.

Osaka, April 27, 1917 (Nohira).

Erioptera (*Acyphona*) *asymmetrica* Alex.

Kioto, April to June, 1916 (Nohira).

Erioptera (*Hoplolabis*) *asiatica* Alex.

Kioto, April to June, 1916 (Nohira).

Female.—Length, 5 mm.; wing, 4.4 mm.

Rostrum and palpi brown. Antennæ dull yellow; apical segments a little more brownish; flagellar segments short-oval. Head yellowish-brown.

Thorax brownish-yellow; if any bloom is present, it is destroyed by emersion in alcohol; the usual brownish stripes present on the præscutum; pseudosutural foveæ distinct, dark brown. Pleura dull yellow, the mesopleura more brownish. Halteres yellow. Legs with the coxæ brown, the posterior coxæ darkest; trochanters dull yellow; femora yellowish, brownish at the tips; tibiæ yellow, narrowly darkened apically; tarsi brown. Wings subhyaline, or whitish, with a heavy brown pattern; about seven brown marks along the costal margin, the largest at the base of the sector, tip of Sc_1 and tip of R_1, the last at the tip of vein R_{4+5}; similar but smaller brown marks along the cross-veins and deflections and along the margin at the ends of the longitudinal veins. Venation: the spur in cell *1st* M_2 completely traverses the cell (as in *E. bipartita* O. S.).

Abdominal tergites yellowish-brown, the lateral margin darker. Basal sternites yellow, the apical sternites more brownish.

Conosia irrorata (Wied.).

Kioto, May 25, 1914 (Nohira).

Crypteria japonica Alex.

No specific data, but possibly Kioto (Nohira).

Female.- Length, 7.3 mm.; wing, 8-8.8 mm.

Rostrum, palpi, head and antennæ light yellow. Antennæ with the two basal flagellar segments united into a fusion-segment, there being twelve segments beyond it.

Thorax yellow. Halteres yellow. Legs yellow, the tips of the femora and tibiæ narrowly darkened; tarsi yellowish-brown. Wings subhyaline; veins brown, the costal and sub-costal veins more yellowish, especially near the base of the wings. Venation: *r* barely evident; *Rs* strongly arcuated; second anal veins ending opposite about mid-length of the sector.

Abdominal tergites dull yellow, the basal third to half of the segments brown; sternites yellow.

Nesopeza geniculata, sp. n.

Similar to the genotype, *N. gracilis* (de Meij.) but somewhat smaller (wing of the female, 9.2 mm.). The wings of the teneral type specimen are not fully colored but the distinctive pattern is well indicated. The ground-color is gray, of a paler shade than the dark costal margin which is narrowly bordered behind by a hyaline line; the dark seams along the cord, at the origin of the sector and at the base of the wing are broader; the hyaline spot in cell *2nd* R_1 is trapezoidal in shape, not elongate-oval as in *gracilis;* a small hyaline drop in the end of cell R_5. The venation is quite distinct. The radial cross-vein is but little longer than the tip of R_1 beyond it; the forks of the medial veins are very short and shallow, not of the deep, narrow type of *gracilis;* vein M_1 is no longer than M_{1+2} alone, in *N. gracilis* it is longer than *M* beyond the *r-m* cross-vein and before the last fork.

Holotype, ♀, Tokyo, Japan, August, 1912 (Kuwana).

In an earlier paper (Can. Ent., Vol. 46, p. 157; 1914) I determined this species as being *N. gracilis* (de Meij.) of Java. Since that time I have seen authentic specimens of *gracilis* and find the present species to be a very different form. The two species constitute a well-marked group that is quite distinct from the only other described member of the genus, *N. pallidithorax* (de Meij.) of Java.

Dictenidia fasciata Coq.
Iwate, July, 1916 (Nohira).

Ctenacroscelis mikado (Westw.).
Kioto, July 7 to 20, 1917; Yoshino, July 29, 1913; Tajima, July 7, 1913 (Nohira).

Tipula nohirai (Mats.).
Ichijoji, Kioto, July 21, 1916 (Nohira).
Akakura, Province Echigo, August 7, 1914 (Nohira).

Tipula pulveolosa (Mats.).
Shinano, August 3, 1914 (Nohira).

Tipula aino Alex.
Kioto, March to April 12, 1914 (Nohira).

Tipula coquilletti End.
Kioto, April 20, 1914, (Nohira).
Minomo, near Osaka, October 4, 1914 (Nohira).

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